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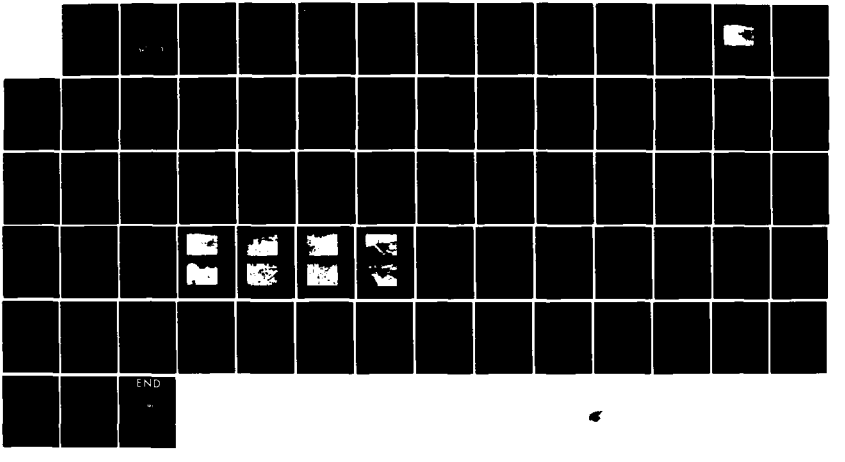

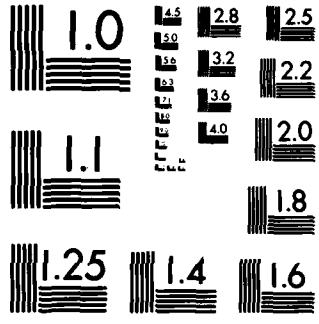

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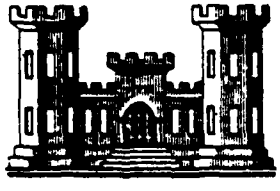
CONNECTICUT RIVER BASIN
SPENCER, MASSACHUSETTS

LAKE WHITTEMORE DAM
MA 00699

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM



DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION, CORPS OF ENGINEERS
WALTHAM, MASS. 02154

AUGUST 1978

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

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18. SUPPLEMENTARY NOTES

Cover program reads: Phase I Inspection Report, National Dam Inspection Program; however, the official title of the program is: National Program for Inspection of Non-Federal Dams; use cover date for date of report.

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

DAMS, INSPECTION, DAM SAFETY,

Connecticut River Basin
Spencer, Massachusetts

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The dam is about 300 ft. long. It consists of a small earth embankment about 15 ft. high and an ungated concrete ogee spillway weir. The dam is in fair to good condition. There are no signs of failure or conditions which would warrent urgent remedial treatment. Hydraulic analyses indicated that the spillway will pass the spillway design flood without overtopping the dam.

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DEPARTMENT OF THE ARMY
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424 TRAPELO ROAD
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REPLY TO
ATTENTION OF:

NEDED

OCT 26 1978

Honorable Michael S. Dukakis
Governor of the Commonwealth of
Massachusetts
State House
Boston, Massachusetts 02133

Dear Governor Dukakis:

I am forwarding to you a copy of the Lake Whittemore Dam Phase I Inspection Report, which was prepared under the National Program for Inspection of Non-Federal Dams. This report is presented for your use and is based upon a visual inspection, a review of the past performance and a brief hydrological study of the dam. A brief assessment is included at the beginning of the report. I have approved the report and support the findings and recommendations described in Section 7 and ask that you keep me informed of the actions taken to implement them. This follow-up action is a vitally important part of this program.

A copy of this report has been forwarded to the Department of Environmental Quality Engineering, the cooperating agency for the Commonwealth of Massachusetts. In addition, a copy of the report has also been furnished the owner, the Town of Spencer, Board of Selectmen, Main Street, Spencer, Massachusetts 01562.

Copies of this report will be made available to the public, upon request, by this office under the Freedom of Information Act. In the case of this report the release date will be thirty days from the date of this letter.

I wish to take this opportunity to thank you and the Department of Environmental Quality Engineering for your cooperation in carrying out this program.

Sincerely yours,

JOHN P. CHANDLER
Colonel, Corps of Engineers
Division Engineer

Incl
As stated

LAKE WHITTEMORE DAM
MA 00699

CONNECTICUT RIVER BASIN
SPENCER, MASSACHUSETTS

PHASE I INSPECTION REPORT
NATIONAL DAM INSPECTION PROGRAM

BRIEF ASSESSMENT

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM

Identification No.:	MA 00069
Name of Dam:	Lake Whittemore
Town:	Spencer
County:	Worcester
State:	Massachusetts
Stream:	None
Date of Site Visit:	12 May 1978

Lake Whittemore Dam is approximately 300 ft. long. It consists of a small earth embankment approximately 15 ft. high and an ungated concrete ogee spillway weir. While the present spillway was built about 20 years ago, the dam was originally constructed before the year 1900.

The dam is generally in fair to good condition. There are no obvious signs of failure or conditions which would warrant urgent remedial treatment.

Hydraulic analyses indicated that the spillway will pass the spillway design flood without overtopping the dam. The spillway design flood selected for this structure was the probable maximum flood.

Recommendations for remedial work include clearing of trees and brush, repair of the downstream fieldstone wall and a dry-laid stone wall adjacent to the gate valve, and minor earthwork and riprap repairs. This work should be undertaken as soon as practical.

HALEY & ALDRICH, INC.
by:

Harl Aldrich
President

This Phase I Inspection Report on the Lake Whittemore Dam has been reviewed by the undersigned Review Board members. In our opinion, the reported findings, conclusions, and recommendations are consistent with the Recommended Guidelines for Safety Inspection of Dams, and with good engineering judgment and practice, and is hereby submitted for approval.

Charles G. Tiersch

CHARLES G. TIERSCH, Chairman
Chief, Foundation and Materials Branch
Engineering Division

Fred J. Ravens Jr.

FRED J. RAVENS, Jr., Member
Chief, Design Branch
Engineering Division

Saul Cooper

SAUL COOPER, Member
Chief, Water Control Branch
Engineering Division

APPROVAL RECOMMENDED:

Joe B. Fryar

JOE B. FRYAR
Chief, Engineering Division

SEP 1[illegible]

PREFACE

This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I Investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I Investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation, and analyses involving topographic mapping, subsurface investigations, testting, and detailed computational evaluations are beyond the scope of a Phase I Investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team. In cases where the reservoir was lowered or drained prior to inspection, such action, while improving the stability and safety of the dam, removes the normal load on the structure and may obscure certain conditions which might otherwise be detectable if inspected under the normal operating environment of the structure.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that unsafe conditions be detected.

Phase I investigations are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established Guidelines, the test flood, referred to in this report as the spillway design flood, is based on the estimated "probable maximum flood" for the region (greatest reasonably possible storm runoff), or a fraction therof. Because of the magnitude and rarity of such a storm event, a finding that a spillway will not pass the test flood should not be interpreted as necessarily posing a highly inadequate condition. The test flood provides a measure of relative spillway capacity and serves as an aide in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition and the downstream damage potential.

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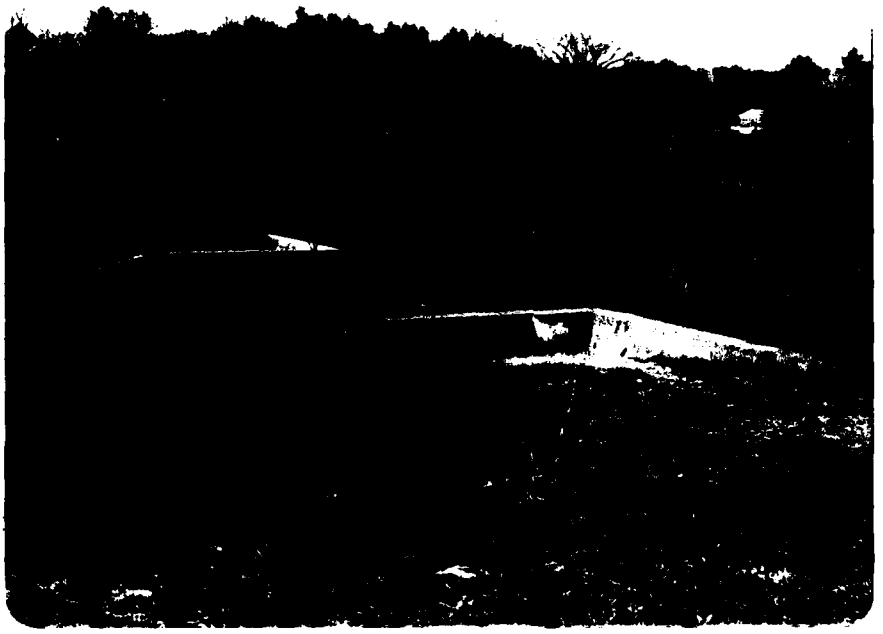
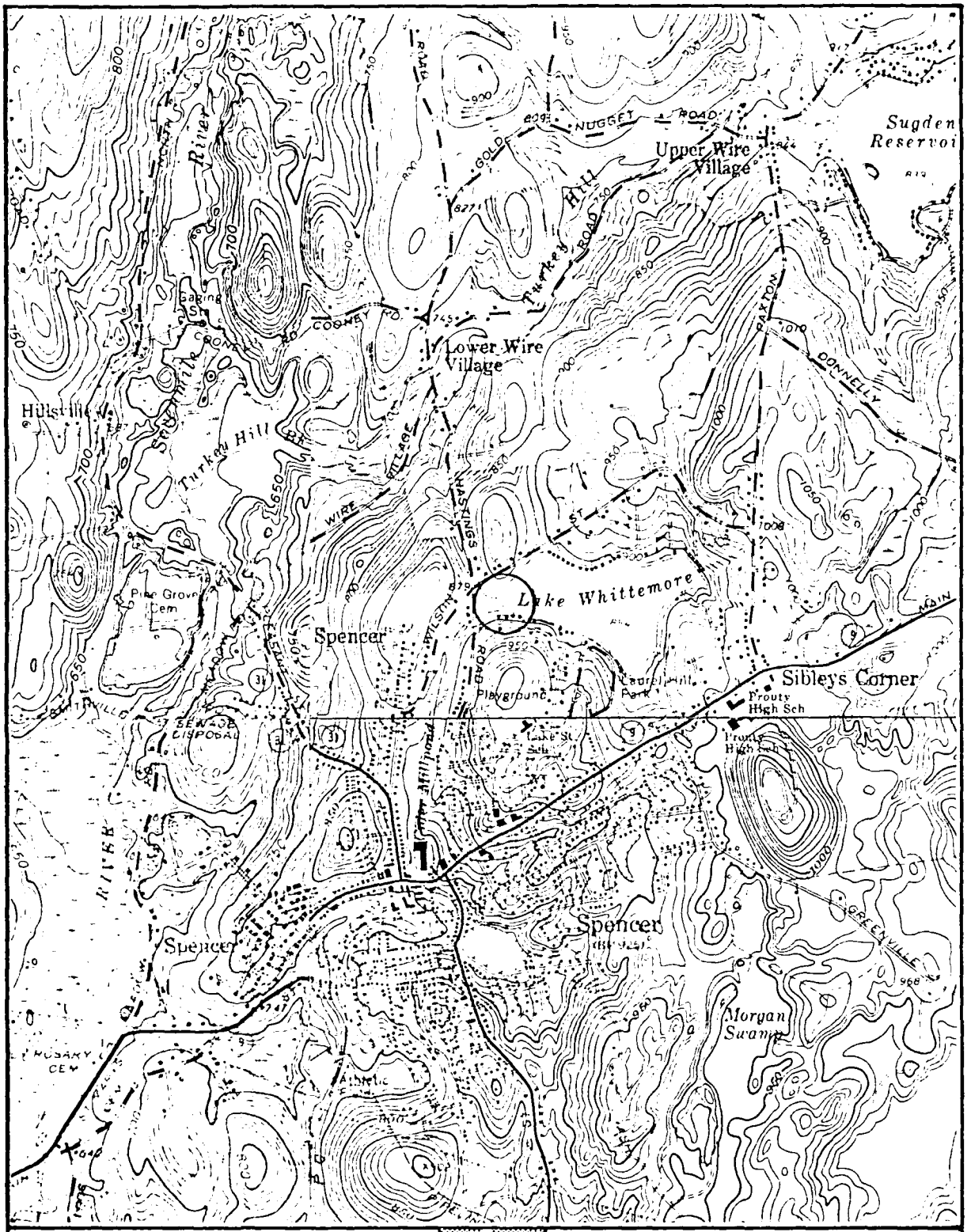


1. Overview of Spillway and Left End of Embankment



FILE NO. 4160

DAM: Lake Whittemore

IDENTIFICATION NO. MA 00699

N

LOCATION MAP

USGS QUADRANGLE

PAXTON, MA

APPROX. SCALE: 1"= 2000'

PHASE I INVESTIGATION REPORT
NATIONAL DAM INSPECTION PROGRAM
LAKE WHITTEMORE DAM
MA 00699

I. PROJECT INFORMATION

1.1 GENERAL

A. Authority. Public Law 92-367, August 8, 1972, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a National Program of Dam Inspection throughout the United States. The New England Division of the Corps of Engineers has been assigned the responsibility of supervising the inspection of dams within the New England Region.

Haley & Aldrich, Inc. has been retained by the New England Division to inspect and report on selected dams in the State of Massachusetts. Authorization and notice to proceed were issued to Haley & Aldrich, Inc. under a letter dated 26 April 1978 from Colonel Ralph T. Garver, Corps of Engineers. Contract No. DACW33-78-C-0301 has been assigned by the Corps of Engineers for this work. Camp, Dresser & McKee, Inc. was retained as consultant to Haley & Aldrich, Inc. on the structural, mechanical/electrical and hydraulic/hyrologic aspects of the investigation

B. Purpose. The primary purposes of the National Dam Inspection Program are to:

1. Perform technical inspection and evaluation of non-Federal dams to identify conditions which threaten the public safety and thus permit correction in a timely manner by non-Federal interests.

2. Encourage and prepare the states to initiate quickly effective dam safety programs for non-Federal dams.

3. To update, verify and complete the National Inventory of Dams.

1.2 PROJECT DESCRIPTION

A. Location. The dam is located north of the Town of Spencer in Worcester County, Massachusetts as shown on the Location Map, page vi. Discharge flow from Lake Whittemore is carried by a creek which meanders through the Town of Spencer and empties into Seven-mile River to the west.

B. Dam and Appurtenances. The Lake Whittemore dam consists of an earth embankment approximately 300 ft. long and an ungated concrete spillway, as shown on a "Site Plan Sketch" included in Appendix C-1.

The maximum height of the embankment is about 15 ft. and the crest is approximately 12 ft. wide. The upstream face is sloped at about 2 horizontal to 1 vertical and is paved with large flat boulders. The downstream face is formed by a vertical fieldstone retaining wall having a maximum height of about 12 ft. Rough cross-section sketches are shown in the 1972 Massachusetts DPW Inspection Report which is included in Appendix B.

The concrete ogee spillway, located at the left abutment, is approximately 20 ft. wide.

A low level outlet pipe, shown on available drawings as a 20 in. culvert, with an old Rodney Hunt gate valve is located near the center of the embankment. The gate mechanism is no longer operable and the outlet pipe which it regulated is not visible either upstream or downstream.

C. Size Classification. Lake Whittemore Dam has an estimated maximum storage of 483.7 acre-feet and a maximum height of approximately 15 ft. Storage of less than 1000 acre-feet and a height of less than 40 ft. classifies this dam in the "small" category, according to guidelines established by the Corps of Engineers.

D. Hazard Classification. Lake Whittemore is currently classified as having a "high" hazard potential in the Corps of Engineers National Inventory of Dams. Because of the existence of approximately eleven culverts between Lake Whittemore Dam and Seven Mile River which all appear to be inadequate to carry a dam failure surge, and

the large number of inhabited structures surrounding these culverts, it is recommended that this classification be retained.

E. Ownership. The lake and dam are presently owned by the Town of Spencer. The address of the owner is: Town of Spencer, Board of Selectmen, Main St., Spencer, MA 01562 (phone: 617/886-2578). Mrs. Margaret A. Gaudette of the Board of Selectmen acted as owner representative during this investigation.

F. Operator. No individual is designated as having responsibility for operation and maintenance of the dam.

G. Purpose of the Dam. Lake Whittemore is presently used for recreational purposes.

H. Design and Construction History. The dam is believed to have been constructed before the year 1900. No records of the original design and construction are available. Modification and repairs at the dam and spillway were proposed in 1939, probably due to damage sustained in the hurricane flood of September 1938. However, the work was apparently not carried out.

The presently existing spillway was designed in 1957 by Hayden, Harding & Buchanan, Inc., Boston, MA and was constructed by Gover Bros., Millbury, MA. Drawings available from Hayden, Harding & Buchanan suggest that the Massachusetts Department of Public Works was also involved in the spillway design. However, no records of this work were located by the Massachusetts Department of Environmental Quality Engineering.

I. Normal Operational Procedures. There is no established routine for operation of the dam. The gate control mechanism for the outlet pipe is not operable.

1.3 PERTINENT DATA

All record plans for Lake Whittemore are on U. S. G. S. Mean Sea Level Datum.

A. Drainage Area. The drainage area at the outlet from Lake Whittemore is 425 acres (0.66 sq. mi.). The lake surface comprises 53 acres (12.5%) of this total. The topography of the watershed is rolling to hilly with an average slope in excess of 5 percent. Less

than 10 percent of the watershed is developed with residences and more than half of the watershed is wooded.

D. Discharge at Damsite. While the maximum known flood at the dam site is very likely that which occurred during the September 1938 hurricane (6± in. rain in 6 hours), the last known significant flood would be that with Hurricane Diane, August 19-20, 1955. This storm produced a total runoff of 10 in. in 36 hours, resulting in a peak inflow of 600 cfs. The routed peak outflow was calculated to be 260 cfs. There have been no significant floods during the past 20 years, or since the dam was reconstructed in 1957-1958.

C. Elevation (ft. above MSL)

1. Top Dam	Approx. 890.0
2. Maximum pool-design surcharge	Unknown
3. Full flood control pool	Unknown
4. Recreation pool	884.5 (Est.)
5. Spillway crest	884.5 (Est.)
6. Upstream portal invert diversion tunnel	Unknown
7. Streambed at centerline of dam	873.5 (Est.)
8. Maximum tailwater	Unknown

D. Reservoir

1. Length of maximum pool	0.5 miles (Est.)
2. Length of recreational pool	0.5 miles (Est.)
3. Length of flood control pool	Unknown

E. Storage (acre-feet)

1. Recreation pool	202.4 (Est.)
2. Flood control pool	Unknown
3. Design surcharge	Unknown
4. Top of dam	483.7 (Est.)

F. Reservoir Surface (acres)

1. Top of dam	65.2 (Est.)
2. Maximum pool	53.0 (Est.)
3. Flood-control pool	Unknown
4. Recreation pool	53.0 (Est.)
5. Spillway crest	53.0 (Est.)

G. Dam

1. Type	Earth
2. Length	Approx. 300 feet
3. Height	Approx. 15 feet
4. Top Width	Approx. 12 feet
5. Side Slopes	Approx. 2:1 U/S, Vertical D/S (Fieldstone Wall)
6. Zoning	Unknown
7. Impervious Core	Unknown
8. Cutoff	Unknown
9. Grout Curtain	Unknown

H. Diversion and Regulating Facilities. Not applicable.

I. Spillway

1. Type	Ungated concrete ogee weir
2. Length of weir	20 feet
3. Crest elevation	Approx. 884.5 (5.5 ft. below top of dam)
4. Gates	None
5. U/S Channel	N/A
6. D/S Channel	2% slope

J. Regulating Outlets. The only outlet is a low-level reservoir drain, presently inoperable. The outlet pipe is a 20 in. culvert, according to available drawings. However, neither the inlet nor outlet end is visible.

II. ENGINEERING DATA

2.1 DESIGN AND CONSTRUCTION RECORDS

No records of original design and construction are available.

A blueprint, dated 1939, was located by the Board of Selectmen, Spencer, MA. This document shows proposed modifications and repairs to the dam and spillway. Field observations indicate discrepancies between details shown on the 1939 blueprint and the presently existing features, which suggest that the work proposed in 1939 may not have been constructed.

Some 1957 design drawings for reconstruction of the embankment, spillway and outlet works are available from Hayden, Harding & Buchanan, Boston, MA. No records of the actual construction were located. However, details shown on drawings are in good agreement with field observations.

2.2 OPERATION RECORDS

No operational records are available.

2.3 EVALUATION

A. Availability. Documents described above are available at the offices of the Board of Selectmen, Spencer, MA and Hayden, Harding & Buchanan, Inc., Boston, MA, as listed in Appendix B-1.

B. Validity. As stated above, the validity of information shown on the 1939 blueprint is questionable. Based on visual field observations, the Hayden, Harding & Buchanan design drawings appear to represent the features of presently existing dam with reasonable accuracy.

C. Adequacy. The available data, in combination with the visual evaluation described in the following section is adequate for the purposes of the Phase I Investigation.

III. VISUAL EXAMINATION

3.1 FINDINGS

A. General. The Phase I visual examination of the Lake Whittemore dam was conducted on 12 May 1978.

In general, the dam embankment was found to be in fair to good condition. The spillway concrete is in good to excellent condition. Some deficiencies which require correction were noted.

A visual inspection check list is included in Appendix A and selected photographs of the project are given in Appendix C.

B. Dam. The earth dam embankment is generally in fair to good condition. There was no evidence of settlement, lateral movement or other serious defects. The upstream slope which is "paved" with large flat boulders is in good condition.

The following deficiencies were noted:

1. The embankment is covered by small saplings and brush. In addition, large trees are growing immediately downstream of the fieldstone wall which retains the downstream slope. These conditions are shown on Photos No. 1, 2, 5 and 6.

2. The fieldstone wall itself, while generally in fair to good condition, has failed at one location between the outlet pipe and the spillway, Appendix C-1. This section of wall is shown in Photo No. 6.

3. Flat granite stones placed on each side of the gate valve to form a near-vertical wall on the upstream side, appear to be in unstable condition. Photo No. 8 shows this condition.

4. At both the left and right spillway walls, the top of the embankment is below the top of the concrete wall as shown in Photos No. 1, 2 and 3.

5. The ground is wet at the toe of the fieldstone wall in an area north of the discharge pipe. Some seepage through the embankment is indicated. The water is clear.

C. Appurtenant Structures. The spillway concrete is in good to excellent condition. A small amount of the concrete surface has eroded from the side wall surface immediately adjacent to the weir. The riprap transition at the downstream end of the side walls has been displaced on the left side and uplifted on the right side.

The gate valve for the reservoir drain, located at the highest point of the dam, is supported by cantilevered steel channels counterweighted by a poured in-place concrete block. Visible portions of the gate valve structure appeared to be in good to excellent condition. The adjacent dry masonry stone wall contains several displaced stones which require attention, Photo No. 8. The gate handle is not present and the valve is reported to be inoperative due to a broken pin. Minor rust stained seepage was noted in the area of the downstream end of the drain pipe. The drain outlet was not located and believed to be covered with soil.

D. Reservoir Area. The area around Lake Whittemore has been developed for residential purposes. Natural ground slopes toward the lake at slopes which are typically from 5 to 15 percent. There is no potential for significant landslides into the pond. There are no well-defined streams entering the lake and thus there are no conditions which could result in a sudden increase in sediment load to the reservoir.

E. Downstream Channel. Side slopes for the channel immediately downstream of the spillway weir, as well as the channel bottom, are paved with large boulders. Some brush and saplings have developed. Nevertheless, the channel is generally unobstructed and in good condition.

Farther downstream, the spillway discharge channel narrows and makes two 90 degree turns to join the old brook channel. Appendix C-1. The channel is narrow and the area is wooded.

3.2 EVALUATION

Little or no maintenance of Lake Whittemore dam has been undertaken in recent years and some deficiencies which require correction have been observed. Nevertheless, based on the visual examination, there appears to be no significant potential for failure of the dam at this time.

IV. OPERATIONAL PROCEDURES

There are no established operational procedures, maintenance programs or warning systems in effect for this dam.

For a structure of this type, which is classified in the "high" hazard category, a periodic observation and maintenance program should be established to examine the dam, control trees and brush and maintain slopes, walls and channels.

V. HYDRAULIC/HYDROLOGIC

5.1 EVALUATION OF FEATURES

A. Design Data. A set of plans entitled "Proposed Reconstruction of Dam at Lake Whittemore - Spencer, Mass." bearing date of April 1957 were apparently the basis for the reconstruction of this facility some 20 years ago. The plans show that the top of dam was raised approximately 1 ft. to Elev. 890.0 (U.S.G.S. datum) during the reconstruction with the new spillway crest of reinforced concrete at Elev. 884.5.

Calculations performed by Hayden, Harding & Buchanan, Inc. during the design of this facility used hyrologic data gathered from the Hurricane Diane storm, August 19 and 20, 1955 and established a peak rate of inflow based on rainfall records and recorded peak rates of runoff at U.S.G.S. gaging stations. A total storm rainfall of 14 in. at Lake Whittemore was considered to generate a total runoff of 10 in. in 36 hours with a peak rate of inflow of 600 cfs occurring 5.2 hours after the start of the storm. This flow was routed through spillways 40 ft. and 20 ft. in length. The maximum outflow for the 20 ft. spillway was 260 cfs with a head of 2.3 ft. over the spillway crest. The recommended spillway design flood (SDF), for the size (small) and hazard potential (high) classification of this dam is between one-half the probable maximum flood (1/2 PMF) and the probable maximum flood (PMF).

B. Experience Data. Because of the small magnitude of the drainage area, the "SCS-TP-149, Method For Estimating Volume and Rate of Runoff in Small Watersheds" was used as a guide for determining the inflow hydrographs into Lake Whittemore for the 100-year storm and the PMF. These two floods were routed through the spillway using the method for flood routing presented in "Water Supply and Wastewater Disposal" by Fair and Geyer. The normal pool level (at the crest of the spillway) was used as the starting point of this routing procedure. The 100-year storm was based on a 4.7 in. rainfall in 6 hours and was found to have a peak inflow rate of 395 cfs which when routed through the lake was reduced to a maximum outflow of 80 cfs. The PMF was based on a 23-in. rainfall in 6 hours and resulted in a peak inflow rate of 4150 cfs which when routed through the lake reduced to a maximum outflow rate of 730 cfs.

Although there are no known records of lake levels reached during past floods, records on gaged watersheds in the immediate area suggest that the greatest flood was very likely that which occurred with the September 1938 hurricane when more than 6 in. of rain was recorded in a 6-hr. period.

The storm associated with Hurricane Diane on August 19-20, 1955 produced a total runoff of 10 in. in 36 hours, which resulted in a peak inflow rate of 600 cfs. No other floods have occurred in the past 20 years.

C. Visual Observations. On the date of the inspection no conditions were observed that would indicate a reduction of capacity of the spillway during a flood occurrence. The condition of the concrete in the ogee crest and wingwalls as well as the downstream apron are good. The pool just upstream of the dam has a gradually sloping bottom with boulders and cobbles partially silted in that should not cause debris to collect on or adjacent to the spillway. The channel immediately downstream of the apron consists of heavy stone riprap for about 30 ft. while downstream of this point the earthen channel has a base width of 4-6 ft. and is 2-3 ft. below the adjacent terrain.

About 400-ft. downstream of the dam, flow is conveyed beneath Hastings Road in a culvert after which it flows in a deep ravine between Wilson Street and Hastings Road before passing beneath Main Street 0.8 mile downstream. There are numerous additional culverts between the dam and Seven Mile River, all of which appear to be inadequate to carry a surge from a failure of Whittemore Dam, if it were to occur. Since there are a large number of inhabited structures in the area, considerable flooding would probably occur.

D. Overtopping Potential. As stated previously, based on the size and hazard classifications published in the Guidelines, the probable maximum flood (PMF) was selected as the spillway design flood (SDF). A spillway rating curve was constructed which showed that the spillway could safely pass approximately 850 cfs. Therefore, the spillway is adequate for the PMF.

E. Evaluation. Inasmuch as the spillway capacity is in excess of the spillway design flood, a range from 1/2 PMF to PMF, the spillway capacity of Lake Whittemore Dam is deemed to be adequate based on criteria published in the Guidelines.

VI. STRUCTURAL STABILITY

6.1 EVALUATION OF EMBANKMENT STRUCTURAL STABILITY

A. Visual Observations. No visual evidence of embankment structural instability was noted during the site examination on 12 May 1978.

B. Design and Construction Data. A theoretical analysis of the structual stability of the dam embankment was not possible due to lack of pertinent design and construction data. However, the embankment cross-section in relation to lake level compares favorably with other low embankments which have proven to be safe.

C. Operating Records. Not applicable.

D. Post-Construction Changes. There have been no known structural changes to the earth embankment.

E. Seismic Stability. Since the Lake Whittemore Dam is located in Seismic Zone 2, the scope of work has not included a study of stability during earthquake events. In the event of a significant earthquake, it is probable that additional failures of the fieldstone wall at the downstream toe will occur. Nevertheless, these failures are not likely to result in failure of the dam and flooding downstream.

6.2 EVALUATION OF SPILLWAY STRUCTURAL STABILITY

A. Visual Observations. There was no visual evidence of movement or distress in the spillway concrete.

B. Design and Construction Data. A theoretical structural analysis of the spillway was not possible due to the lack of pertinent data. The present condition of the spillway after a reported 20 years of operation indicates the spillway is currently stable.

C. Operating Records. No operating records are known to exist for the spillway.

D. Post-Construction Changes. The current spillway was constructed approximately 20 years ago. This may be the third spillway constructed for the dam as 1939 plans for rehabilitation of the dam indicate a different type of spillway than that currently in existence.

E. Seismic Stability. A theoretical analysis for seismic stability of the spillway is not possible due to the lack of pertinent design data. The low height of the spillway weir, approximately four feet, the indication of continuity between side walls and weir, and the location of the structure in Zone 2 seismic risk area indicate that seismic stability should not be a problem.

VII. ASSESSMENT, RECOMMENDATIONS AND REMEDIAL MEASURES

7.1 DAM AND ASSESSMENT

A. Condition. The visual examination of the earth embankment and spillway reveal that the Lake Whittemore Dam is generally in fair to good condition. There are no obvious signs of failure or conditions which would warrant urgent remedial treatment. Some maintenance is required, however.

Based on the results of the computations included as Appendix D, the spillway is capable of passing the probable maximum flood without overtopping the dam.

B. Adequacy of Information. The data available concerning the design and construction of the dam, is considered adequate for a Phase I Investigation when supplemented by field observations.

C. Urgency. It is recommended that remedial work outlined in Section 7.3 be undertaken as soon as practical.

D. Need for Additional Investigation. Additional investigation is not believed to be necessary.

7.2 RECOMMENDATIONS FOR ADDITIONAL INVESTIGATIONS

Not applicable.

7.3 REMEDIAL MEASURES

A. Alternatives. Not applicable.

B. Operation and Maintenance, and Procedures. It is recommended that the following remedial work be undertaken by the Town of Spencer to correct deficiencies noted during the visual examination:

1. Cut all brush and trees on the earth embankment and keep the embankment free of such growth. Grass slopes which are mowed at least once a year will allow for a more careful visual examination of the embankment.

2. Cut trees which are located within 12 ft. of the fieldstone wall at the downstream toe of the dam. A severe windstorm could uproot these trees and damage the wall.

3. Repair the failed section of the fieldstone wall.

4. Reconstruct and/or stabilize the stone wall on the upstream face of the dam adjacent to the gate valve. To properly examine and repair the wall, the lake level will probably have to be lowered.

5. Place earth fill on the embankment both sides of the spillway to restore embankment grades to an elevation which is level with the top of concrete.

6. Reset riprap at the downstream transition banks of the spillway.

7. Locate the downstream drain pipe outlet and clear area around it.

Although the dam is in fair to good condition, it is considered important that the following items also be accomplished:

1. Due to the "high" hazard potential classification, surveillance of the dam should be provided by the Town of Spencer during periods of unusually heavy precipitation. The Town of Spencer should develop a formal emergency preparedness plan and warning system in cooperation with local officials.

2. It is recommended that the Town of Spencer establish a formal program to periodically inspect the dam and to provide for routine maintenance. Responsibility for the activity should be assigned to one person or to a board reporting directly to the Board of Selectmen.

3. The low level drain for the reservoir is inoperable due to a defective valve. Although not critical, it would be highly desirable to have the gate valve repaired and properly maintained. If it became necessary during an emergency to lower the lake level before the gate is repaired, a series of siphons and/or pumps could be utilized.

APPENDIX A
INSPECTION TEAM ORGANIZATION AND CHECK LIST

VISUAL INSPECTION PARTY ORGANIZATION

NATIONAL DAM INSPECTION PROGRAM

Dam: Lake Whittemore

Date: 12 May 1978

Time: 1520-1700

Weather: Clear and Warm (high 70's)

Water Surface Elevation Upstream: Not known (at top of spillway crest)

Stream Flow: Not known

Inspection Party:

Harl P. Aldrich, Jr. Haley & Aldrich, Inc.	- Soils
Allen W. Hatheway Haley & Aldrich, Inc.	- Geology
Roger H. Wood Camp, Dresser & McKee, Inc.	- Structural/Mechanical

Present During Inspection:

John W. Critchfield, Haley & Aldrich, Inc.
Roger Bemis, Town of Spencer citizen

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Whittemore DATE: 12 May 78

AREA EVALUATED	CONDITION
DAM EMBANKMENT	
Crest Elevation	Not known (approximately 5.5 ft. above spillway crest)
Current Pool Elevation	Not known (at crest of spillway)
Maximum Impoundment to Date	Not known
Surface Cracks	None observed
Pavement Conditions	No pavement
Movement or Settlement of Crest	None observed; however, some settlement or loss of ground has occurred immediately behind downstream fieldstone wall
Lateral Movement	None observed
Vertical Alignment	Fairly good
Horizontal Alignment	Good
Condition at Abutment and at Concrete Structures	Some erosion at spillway, abutments, earth somewhat below top of concrete walls
Indications of Movement of Structural Items on Slopes	No structural items on slopes
Trespassing on Slopes	Unrestricted, crest of dam has frequent human traffic
Animal Burrows in Embankment	None observed
Vegetation on Embankment	Grass, brush and small saplings; no large trees
Sloughing or Erosion of Slopes or Abutments	Some noted, not considered serious
Rock Slope Protection - Riprap Failures	From water line to top of dam, rock riprap in excellent condition. Large stones are flat to form "smooth paving"
Unusual Movement or Cracking at or near Toes	Downstream toe of dam is a dry laid fieldstone wall, in fair to good condition (see text of report)
Unusual Embankment or Downstream Seepage	Some seepage (wet spot) noted at bottom of stone wall (see text of report)
Piping or Boils	None observed
Foundation Drainage Features	None
Toe Drains	None
Instrumentation Systems	None

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Whittemore DATE: 12 May 78

AREA EVALUATED	CONDITION
OUTLET WORKS - SPILLWAY WEIR, APPROACH AND DISCHARGE CHANNELS	
a. Approach Channel	
General Condition	No channel present - spillway is at edge of reservoir
Floor of Approach Channel	Good - minor stones and small debris in front of weir
b. Weir, Training Walls & Apron	
General Condition of Concrete	Concrete in good to excellent condition, slight erosion in walls adjacent to weir
Rust or Staining	None observed
Spalling	Very minor
Any Visible Reinforcing	None observed
Any Seepage or Efflorescence	None observed
Drain Holes	4 in apron approximately 4 in. in diameter
c. Discharge Channel	
General Condition	Apron in good condition, no undercut noted
Loose Rock Overhanging Channel	Riprap transition displaced left site - uplifted right side
Trees Overhanging Channel	Trees and brush occur along channel but no significant obstructions
Floor of Channel	Cobbles and boulders immediately downstream of spillway apron
Other Obstructions	None observed
CONTROL WORKS, RESERVOIR DRAIN	
a. Concrete and Structural	
General Condition	Good

FILE NO. 4160

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

VISUAL INSPECTION CHECK LIST
NATIONAL DAM INSPECTION PROGRAM

DAM: Lake Whittemore DATE: 12 May 78

AREA EVALUATED	CONDITION
Unusual Seepage or Leaks	Leakage at downstream end of drain pipe, rust stained. Pipe apparently beneath soil, not visible
Rusting or Corrosion of Steel	Steel in good condition
b. Mechanical and Electrical	(No electrical facilities)
Reservoir Drain	No operating handle, valve reported inoperable due to broken pin. Also reported operator shaft bronze above water cast iron below water (visual indications of iron below water surface). Rust at exit end indicates iron pipe.
c. Channel	
Condition	Stagnant water; channel filled with rotting vegetation, stones, debris

FILE NO. 4160

HALEY & ALDRICH, INC.
CAMBRIDGE, MASSACHUSETTS

APPENDIX B
LIST OF AVAILABLE DOCUMENTS AND PRIOR INSPECTION REPORTS

LIST OF AVAILABLE DOCUMENTS
LAKE WHITTEMORE

DOCUMENT	CONTENTS	LOCATION
"Whittemore Lake Dam" by E. A. Chamberlin, 1939	Blue Print showing proposed repairs to dam and spillway	Board of Selectmen Spencer, MA
Design Drawings, "Proposed Reconstruction of Dam", by Hayden, Harding & Buchanan, Inc., Boston, MA April 1957	A General Plan, Cross Sections, Structural Details and Hydrologic/Hydraulic Data	Hayden, Harding & Buchanan, Inc.

OF/BR

INSPECTION REPORT - DAMS AND RESERVOIRS

1. Location: City/Town SPENCER Dam No. 3-14-230-21

   Name of Dam WHITTEMORE Inspected by R. NICHOLSON

   Date of Inspection 5/10/72

2. Owner/s: per: Assessors ✓ Prev. Inspection _____

   Reg. of Deeds _____ Pers. Contact _____

	Name	St. & No.	City/Town	State	Tel. No.
1.	~~SELECTMEN~~	TOWN OF SPENCER - Board of Selectmen			
2.		Main St.	Spencer		
3.					

3. Caretaker (if any) e.g. superintendant, plant manager, appointed by absentee owner, appointed by multi owners.

   Name: St. & No.

   City/Town: State: Tel. No.

4. No. of Pictures taken 0

5. Degree of Hazard: (if dam should fail completely)*

   1. Minor _____ 2. Moderate ✓

   3. Severe _____ 4. Disastrous _____

   *This rating may change as land use changes (future development)

6. Outlet Control: Automatic _____ Manual ✓

   Operative _____ Yes; ✓ No.

   Comments:

7. Upstream Face of Dam: Condition:

   1. Good ✓ 2. Minor Repairs _____

   3. Major Repairs _____ 4. Urgent Repairs _____

   Comments:
   STONE RIP RAP FACE.

DAM NO. 3-14-280-21

8. Downstream Face of Dam:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

9. Emergency Spillway:

Condition: 1. Good ✓ 2. Minor Repairs _____

3. Major Repairs _____ 4. Urgent Repairs _____

Comments:

10. Water Level at time of inspection: 5' ft. above ___ below ✓

top of dam ✓ principal spillway _____

other _____

11. Summary of Deficiencies Noted:

Growth (Trees and Brush) on Embankment 2"-12"

Animal Burrows and Washouts NONE

Damage to slopes or top of dam NONE

Cracked or Damaged Masonry NO

Evidence of Seepage NONE

Evidence of Piping NONE

Erosion NONE

Leaks NONE

Trash and/or debis impeding flow NONE

Clogged or blocked spillway NO

Other _____

DAM NO. 3-14-280-21

12. Remarks and Recommendations: (Fully Explain)

13. Overall Condition:

1. Safe ✓
2. Minor repairs needed _____
3. Conditionally safe - major repairs needed _____
4. Unsafe _____
5. Reservoir impoundment no longer exists (explain)

   Recommend removal from inspection list _____

DESCRIPTION OF DAM

DISTRICT III

Submitted by P. NICHOLSON Dam No. 3-14-360-21

Date 5/10/72 City/Town SPENCER

Name of Dam WHITTEMORE LAKE

1. Location: Topo Sheet No. 206

Provide 8½" x 11" in clear copy of topo map with location of Dam clearly indicated.

2. Year built: _____ Year/s of subsequent repairs _____

3. Purpose of Dam: Water Supply _____ Recreational ✓

Irrigation _____ Other _____

4. Drainage Area: _____ sq. mi. _____ acres

5. Normal Ponding Area: _____ acres; Ave. depth ?

Impoundment: _____ gals; _____ acre ft.

6. No. and type of dwellings located adjacent to pond or reservoir 20-25 i.e. summer homes, etc. SUMMER + YEAR ROUND

7. Dimensions of Dam: Length 300' ± Max. Height 12'

Slopes: Upstream Face 2:1

Downstream Face 2:1

Width across top 12' ±

8. Classification of Dam by Material:

Earth ✓ Conc. Masonry _____ Stone Masonry ✓

Timber _____ Rockfill _____ Other RIP RAP

9. A. Description of present land usage downstream of dam:

_____% rural; 100 % urban.

B. Is there a storage area or flood plain downstream of dam which could accomodate the impoundment in the event of a complete dam failure? yes _____ no ✓.

DAM NO. 3-14-230-21

10. Risk to life and property in event of complete failure.

No. of people 20-30.

No. of homes 6 4.

No. of Businesses 1.

No. of industries _____. Type _____

No. of utilities _____. Type _____

Railroads _____.

Other dams 3-14-230-20.

Other _____.

11. Attach Sketch of dam to this form showing section and plan on 8½" x 11" sheet.

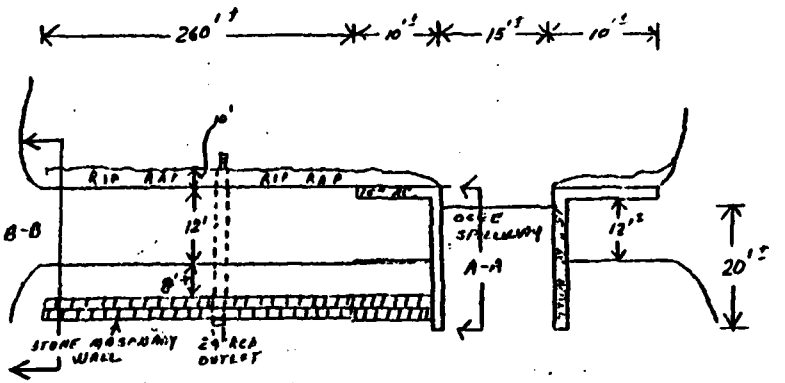
12. How To LOCATE:

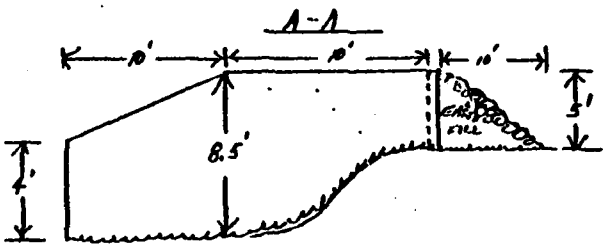
NORTH ON GROVE ST FROM JCT OF RTE #9 TO JCT OF WILSON & HASTINGS ST. EAST 100 YDS ON WILSON ST TO OPEN FIELD ON RIGHT. DAM 100YDS OUT INTO FIELD.

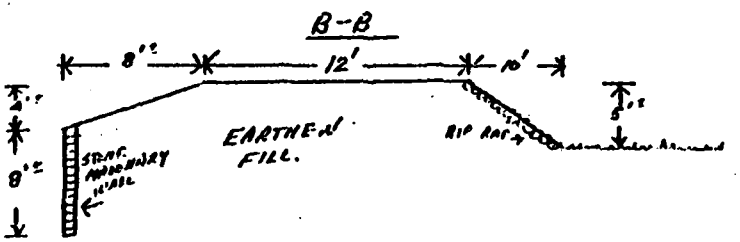

N
17'30"
460 000 FEET
42°15'
72°00'
57'30"
Buck
Moose Hill
Lambs Grove
47-14
Sugden Reservoir
Upper Wire Village
Lower Wire Village
47-28
47-21
Lake Whittemore
Spencer
Sibleys Corner
Tractors Corner
EAST BROOKFIELD 4.1 MI
WARE 15 MI
470 000 FEET
Mapped, edited, and published by the Geological Survey
Control by USGS, USC&GS, and Massachusetts Geodetic Survey
Topography by planetable surveys 1937. Revised 1965
Polyconic projection. 1927 North American datum
10,000-foot grid based on Massachusetts coordinate system, mainland zone
1000-meter Universal Transverse Mercator grid ticks, zone 19, shown in blue
20C
20C

APPENDIX B-7

DAM # 3-14-280-21



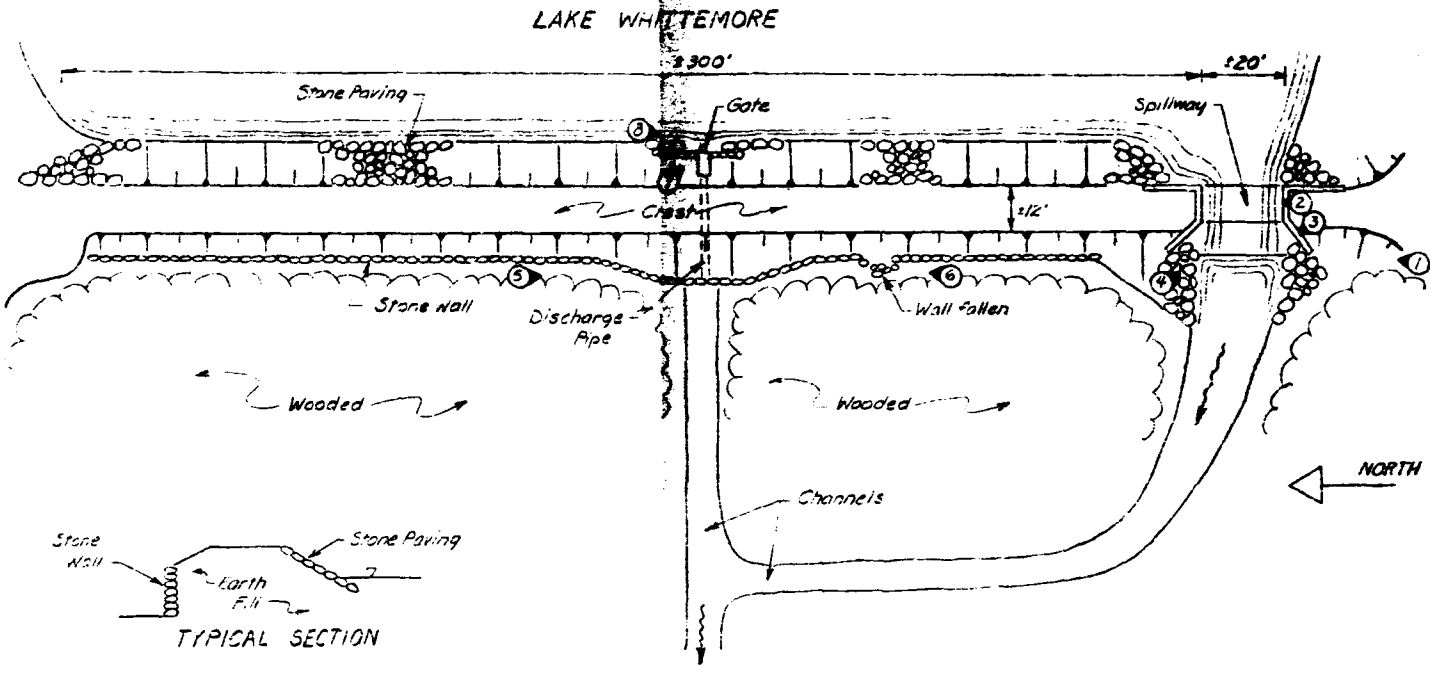




APPENDIX C
SELECTED PHOTOGRAPHS OF PROJECT

LOCATION PLAN

PHOTOGRAPHS



NOTE:
1. Plan sketch and typical section developed from Haley & Aldrich, Inc. field observations

LEGEND:
③ Photograph number and direction of view.

Lake Whittemore Dam
Spencer, Massachusetts

SITE PLAN SKETCH

No Scale July 1978

1. Spillway, viewed from left abutment

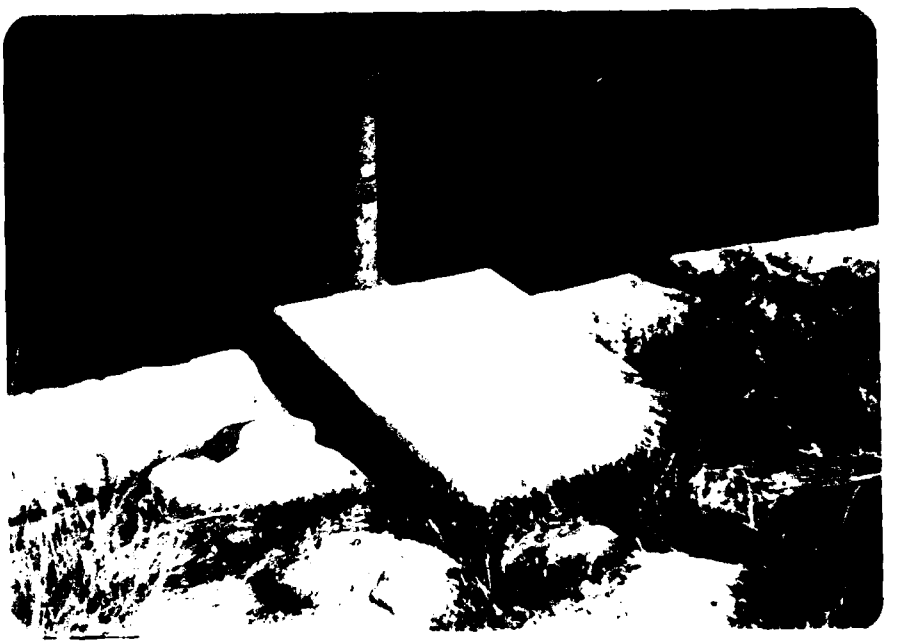
2. Embankment, viewed from left abutment

3. Left spillway training wall, viewed from downstream

4. Downstream channel below spillway

5. Stone wall along downstream face, view toward south

6. Failure of stone wall, view toward north



7. Gate structure

8. Stone wall adjacent to gate structure

APPENDIX D
OUTLINE OF DRAINAGE AREA AND HYDRAULIC COMPUTATIONS

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT: [illegible] | JOB NO. 5?1-3-RT | PAGE 1
PROJECT: Lake Whittemore | DATE CHECKED | DATE 6/22/78
DETAIL: Hydrology Calculations | CHECKED BY | COMPUTED BY [illegible]

Drainage Area, Lake Whittemore

Plan. Rding: 4.63 in²

$4.63 in^2 \times \frac{(2000 ft)^2}{1 in^2} \times \frac{1 acre}{43,560 ft^2} = 425.2 acres$

≈ .664 sq. mi

Length of watershed ≈ 3200'

		Elev.
15%	480'	930'
85%	2720'	1043'

Slope of watershed = .0504 1043'

D.A. Land Use Breakdown:

1. Impervious, Roads ≈ 16 acres
2. Residential ≈ 26 acres (say ½ acre lots)
3. Lake Whittemore ≈ 53 acres
4. Open Spaces ≈ 330.2 acres say 330

Total 425.2 say 425

Assume Hydrologic Soil Group B/C (CEF 6/22/78)

	CN	Acres	CN x A
Imp. Roads	98	16	1568
Residential	75	26	1950
Lake Whittemore	100	53	5300
Open Spaces			
Meadows, etc.	68	110	7480
Forest	63	220	13860
		425	30158

Wtd CN = 70.96 say 71

Rainfall: 100 year 6hr rainfall = 4.7 in
Maximum probable 6hr rainfall = 23 in

CN = 71

$S = \frac{1000}{CN} - 10 = 4.0845$

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT: U.S. A. U.O.I. Group | JOB NO. 561-8-RT | PAGE 2
PROJECT: Lake Whitemore | DATE CHECKED: | DATE: 6 22 78
DETAIL: Hydrology Calculations | CHECKED BY: | COMPUTED BY: [illegible]

$Lag = \frac{l^{.8}(s+1)^{.7}}{1900\sqrt{Y}}$ $l = 3200'$, $S = 4.0845$, $Y = 5.044643\%$

$Lag = \frac{3200^{.8}(5.0845)^{.7}}{1900\sqrt{5.044643}} = 0.466$ hrs

$T_c = \frac{Lag}{.6} = \frac{.466}{.6} = .777$ hrs (≈ 46.6 min)

$\Delta D = 0.4L = 0.4 \times .466$ hrs $= 0.1864$ hrs

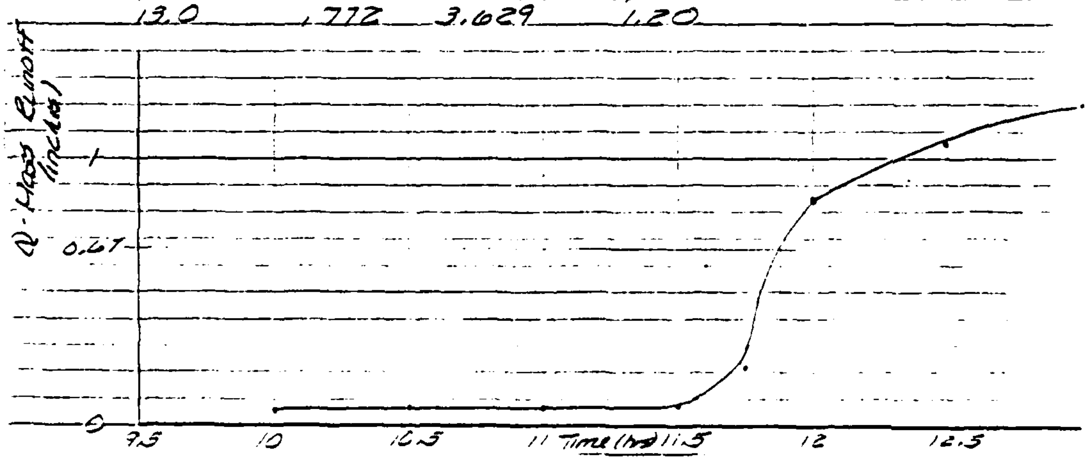
$T_p = \frac{\Delta D}{2} + L = \frac{0.1864}{2} + .466 = .559$ hrs

Effective Peak Producing Runoff Period = $7\Delta D$

$7\Delta D = 7 \times .1864 = 1.3048$ hrs

→ Use 5 in. Initially (100 yr., 6 hr. storm)

Time (hrs)	P/P_{6}	Mass P (inches)	Mass Q (inches)
10.0	0.181	.851	.05
10.5	.204	.959	.06
11.0	.235	1.105	.065
11.5	.283	1.330	.07
11.75	.387	1.819	.22
12.0	.663	3.116	.85
12.5	.735	3.955	1.05
13.0	.772	3.629	1.20



CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT [illegible] JOB NO. [illegible] PAGE 3
PROJECT [illegible] DATE CHECKED ____ DATE [illegible]
DETAIL Hydrology Calculations CHECKED BY ____ COMPUTED BY [illegible]

11.88 - 4.5 (.1864) = 11.04

Computations for Instantaneous Peak Discharge

Increment	Time (hours)	Mass Runoff (inches)	ΔQ (inches)	Δq (cfs)	Y	YΔq
	11.04	.067				
ΔQ_1			.001	.575	0.2	.115
	11.23	.068				
ΔQ_2			.001	.575	0.4	.23
	11.41	.069				
ΔQ_3			.061	35.07	0.6	21.04
	11.60	.13				
ΔQ_4			.27	155.23	0.8	124.18
	11.78	.40				
ΔQ_5			.41	235.71	1.0	235.71
	11.97	.81				
ΔQ_6			.12	69	.667	46.02
	12.16	.93				
ΔQ_7			.09	51.75	.333	17.23
	12.34	1.02				
						444.5

$$\Delta q_p = \frac{484 \times A \times \Delta Q}{\frac{\Delta D}{2} + L} = \frac{484 \times .664}{.559} \Delta Q = 574.9\, \Delta Q$$

Spillway Capacity (Allowing 0' freeboard)

$Q = CLH^{3/2} = 3.8 \times 20 \times 5^{3/2} = 850$ cfs

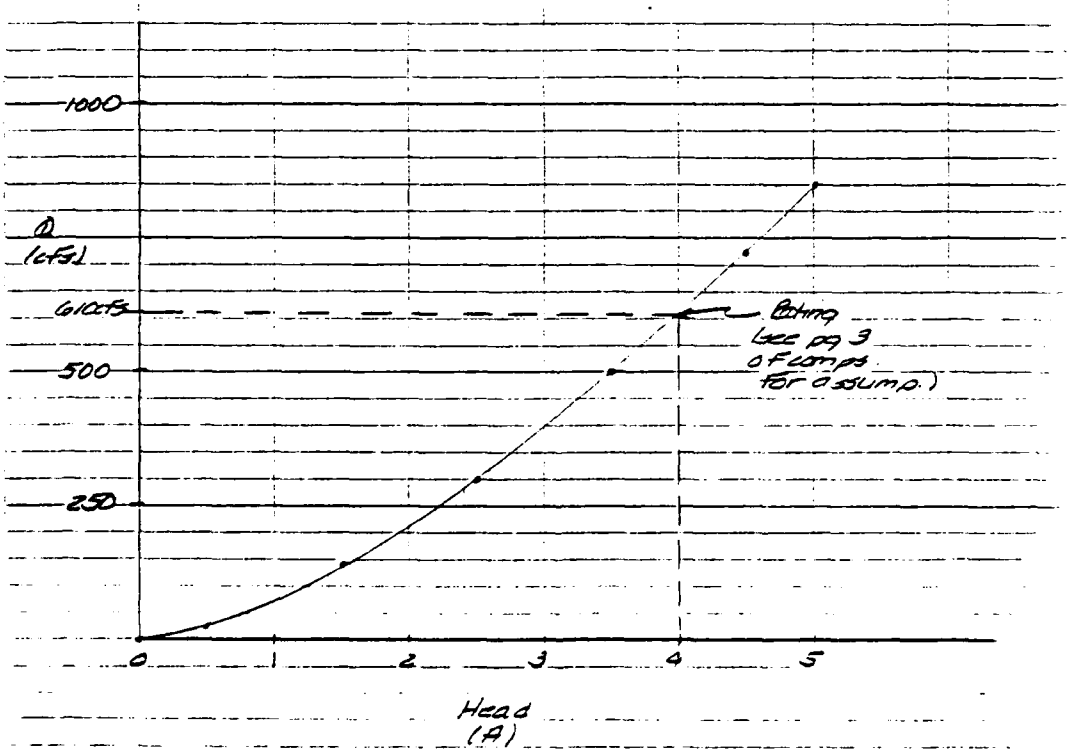
Will take 100 yr, 1/2 PMF, and PMF

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT H&A U.O.T. Group 1 JOB NO 561-A-RT PAGE 32
PROJECT Lake Whitehouse DATE CHECKED DATE 7/3/72
DETAIL Hydrology Calculations CHECKED BY COMPUTED BY DLD

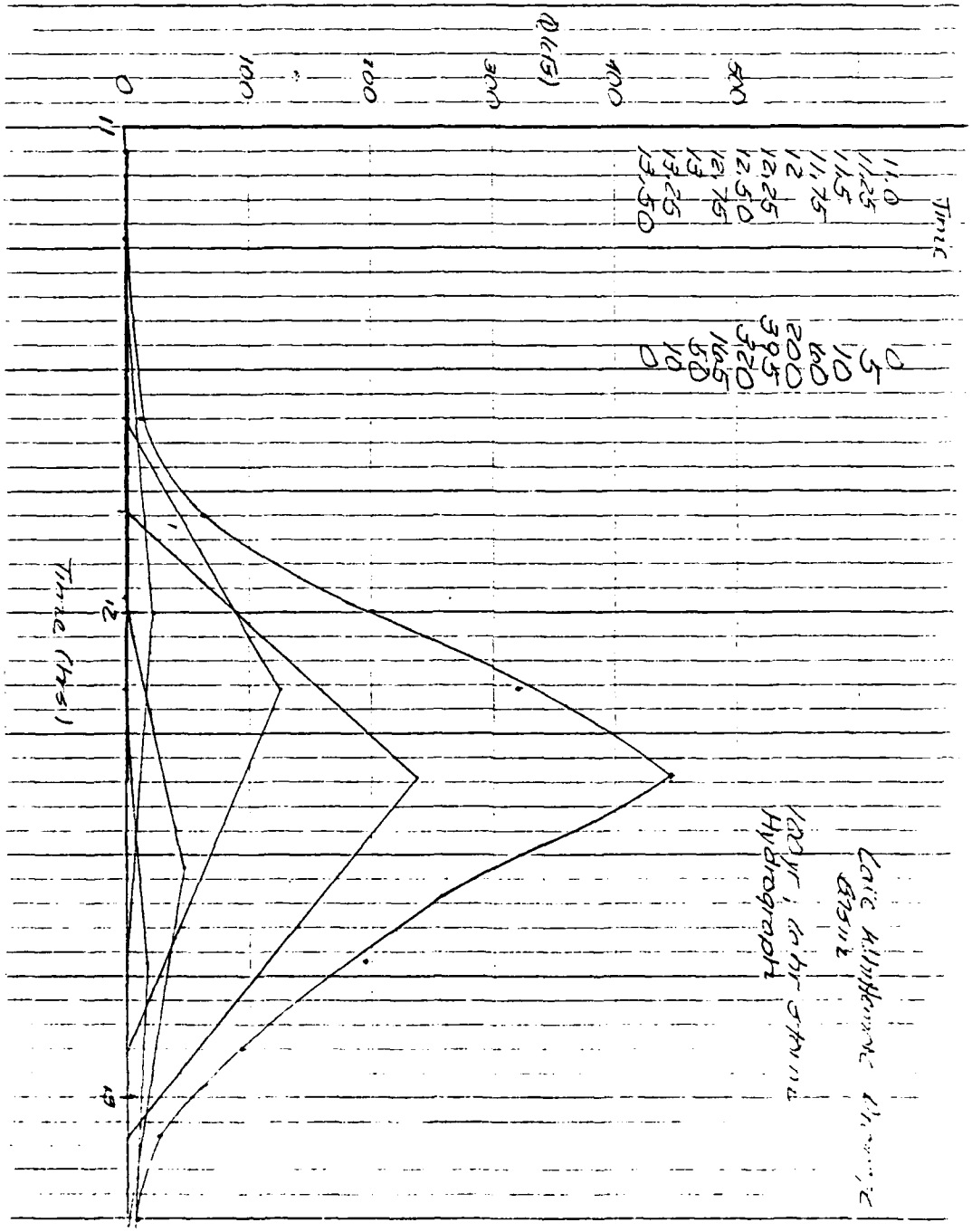
Spillway Rating Curve (taken from calc. pg. 6)

Hd over top Spillway	Elev. of water	Q
0	884.5	0
0.5	885	27
1.5	886	190
2.5	887	400
3.5	888	678
4.5	889	725
5	889.5	850



CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

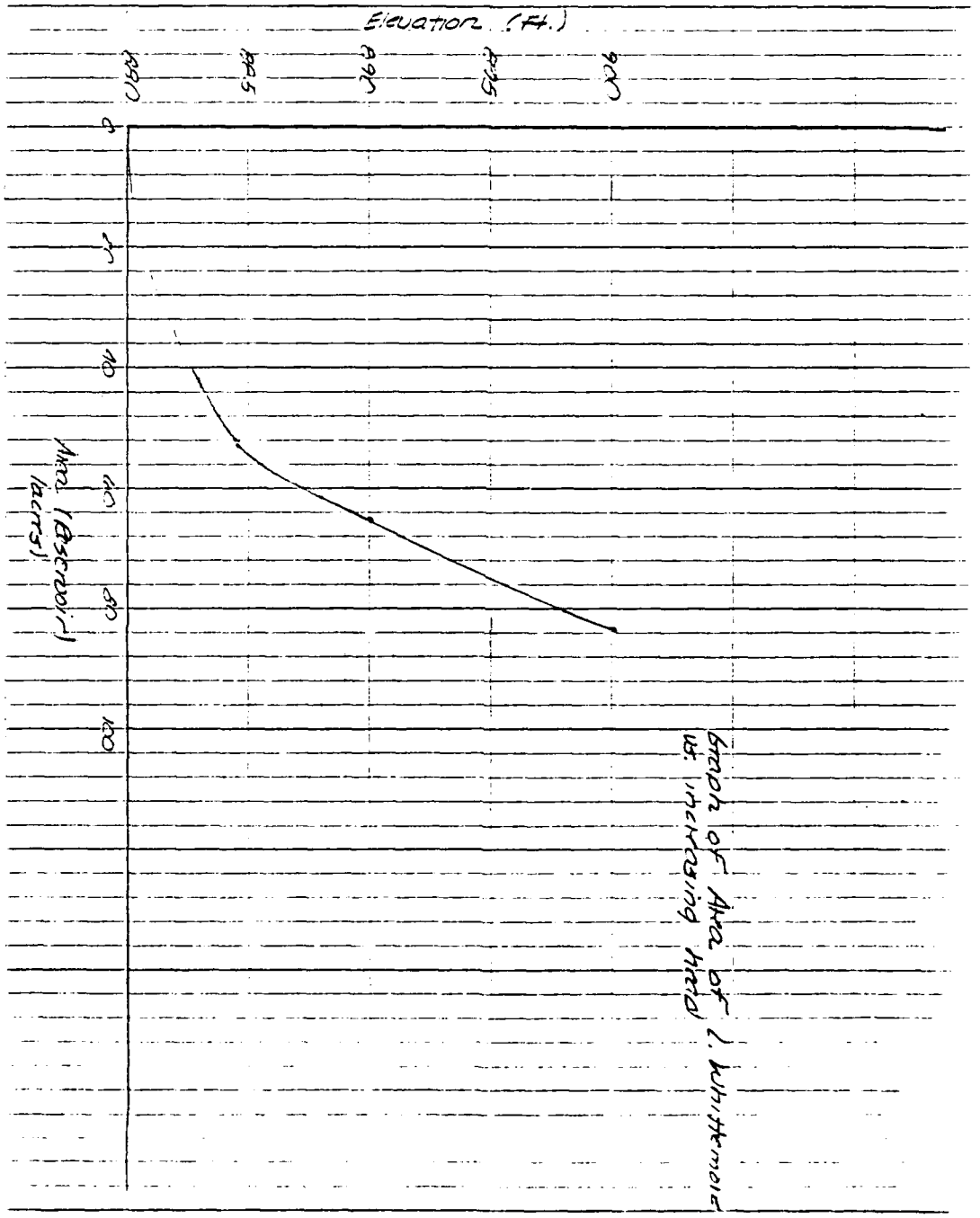
CLIENT [illegible] JOB NO [illegible]
PROJECT [illegible] DATE CHECKED
DETAIL [illegible] CHECKED BY
PAGE 4
DATE 4/23/82
COMPUTED BY [illegible]



APPENDIX D-4

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT H.E.D. / D.O.T. Study JOB NO. 541-2-PT PAGE 5
PROJECT Lake Levels DATE CHECKED DATE 6/23/82
DETAIL Hydrology Analysis CHECKED BY COMPUTED BY DLC



CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

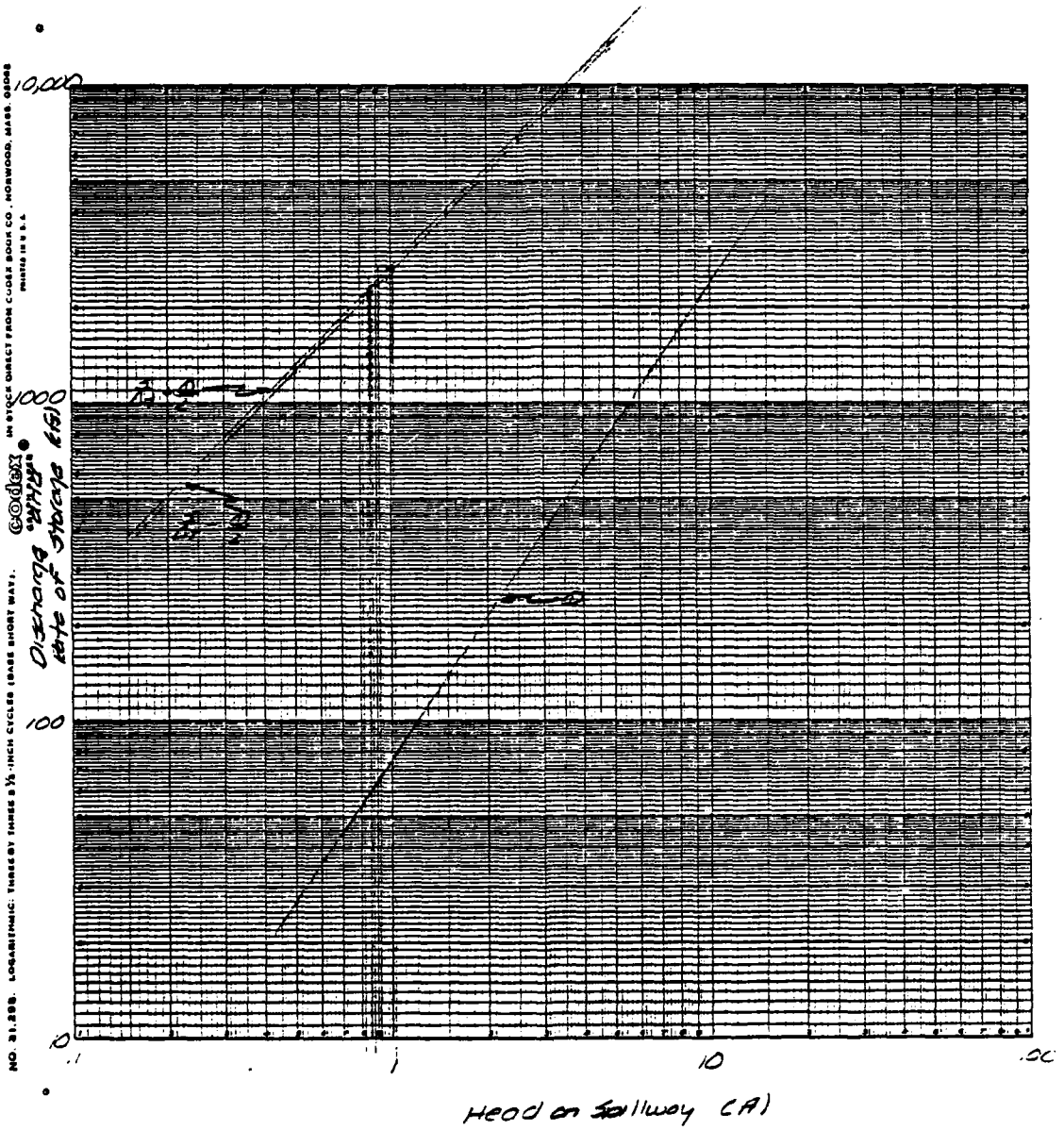
CLIENT USA U.O.T Group 1 JOB NO 561-2-27 PAGE 6
PROJECT Tri-Rivers DATE CHECKED DATE 6/23/75
DETAIL Hydrology Calculations CHECKED BY COMPUTED BY AJC

Calculation of Functional Rates of Storage

Elev. in Spillway #	Hd. in Spillway ft	Reservoir Area acre	C/C Outflow Q (cfs)	C/C Storage acre-ft	$\frac{2}{\Delta t}$ (cfs)	$\frac{2}{\Delta t} - \frac{Q}{2}$ (cfs)	$\frac{2}{\Delta t} + \frac{Q}{2}$ (cfs)
224.5	0	53	0	0	0	0	0
225	.5	54	27	27	1307	1294	1321
226	1.5	57	140	83	4017	3947	4087
227	2.5	59	300	140	6776	6626	6926
228	3.5	61.5	498	201	9728	9479	9977
229	4.5	63	725	263	12729	12,367	13092
230	5.5	65.2	980	327	15827	15,337	16317
231	6.5	67	1260	393	19021	18391	19651

Calculation of Reservoir Out Flows

Time No	Time	Cbs Inflow	Avg. Inflow	$\frac{2}{\Delta t} - \frac{Q}{2}$	$\frac{2}{\Delta t} + Q$	Hd. on Spillway	Out Q (cfs)
0	11.0	0	0				0
1	11.25	5	2.5				5
2	11.5	10	7.5				10
3	11.75	60	35			0.85	60
4	12	200	130	2160	2290	0.50	65
5	12.25	395	298	2250	2498	0.92	68
6	12.5	320	358	2350	2708	1.00	76
7	12.75	165	243	2580	2823	1.04	80
8	13	50	108	2620	2728	1.02	78
9	13.25	10	30	2600	2630	0.97	73
10	13.5	0	5	2500	2505	0.92	68
11	13.75	0	0	2350	2350	0.87	61
12	14.0	0	0	2200	2200	0.81	55
13	14.25	0	0	2020	2020	0.77	51
14	14.5	0	0	1950	1950	0.72	46


10,000
1000
100
10
Discharge (cfs)
Rate of Storage
Head on Spillway (ft)

APPENDIX D-7

CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

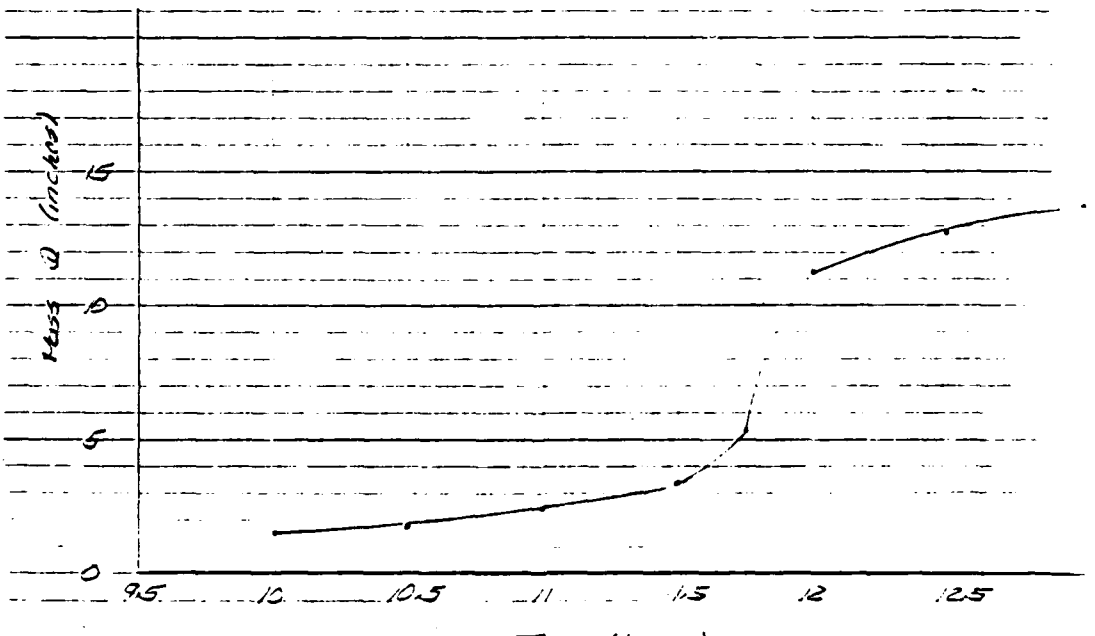
CLIENT MEA, U.D.T. Group 1 JOB NO. 5012-07 PAGE 5
PROJECT Lake Winnisimmet DATE CHECKED DATE 1-21-
DETAIL Hydrology Calc CHECKED BY COMPUTED BY CLG

SCS Method
→ Use 23 in (Maximum Probable Storm)

Time (hrs)	P/P24	Mass P (inches)	Mass Q (inches)
10.0	.131	4.16	1.50
10.5	.204	4.69	1.87
11.0	.235	5.41	2.40
11.5	.283	6.51	3.30
11.75	.387	8.90	5.30
12.0	.663	15.25	11.25
12.5	.735	16.91	12.88
13.0	.772	17.76	13.65

$$Q = \frac{(P-.2S)^2}{P+.8S}$$

11.88 - 9.5 (0.1864) = 10.0



CAMP DRESSER & McKEE
Environmental Engineers
Boston, Mass.

CLIENT [illegible] JOB NO [illegible] PAGE 9
PROJECT [illegible] DATE CHECKED DATE [illegible]
DETAIL Hydrology Calc. CHECKED BY COMPUTED BY [illegible]

Computations for Instantaneous Peak Discharge

Increment	Time hrs.	Runoff (inch)	ΔQ (inch)	Δq (cfs)	Y	YΔq (cfs)
	11.04	2.5				
ΔQ_1			0.3	172.5	0.2	35
	11.23	2.8				
ΔQ_2			0.3	172.5	0.4	69
	11.41	3.1				
ΔQ_3			0.9	517.4	0.6	310
	11.60	4.0				
ΔQ_4			2.7	1552.2	0.8	1242
	11.78	6.7				
ΔQ_5			4.3	2472.1	1.0	2472
	11.97	11.0				
ΔQ_6			0.7	402.4	.667	268
	12.16	11.7				
ΔQ_7			0.8	459.9	.333	153
	12.34	12.5				
						4549

$$\Delta q_p = \frac{484 \times A \times \Delta Q}{\frac{\Delta D}{2} + L} = \frac{484 \times .664}{.559} \Delta Q = 574.9\, \Delta Q$$

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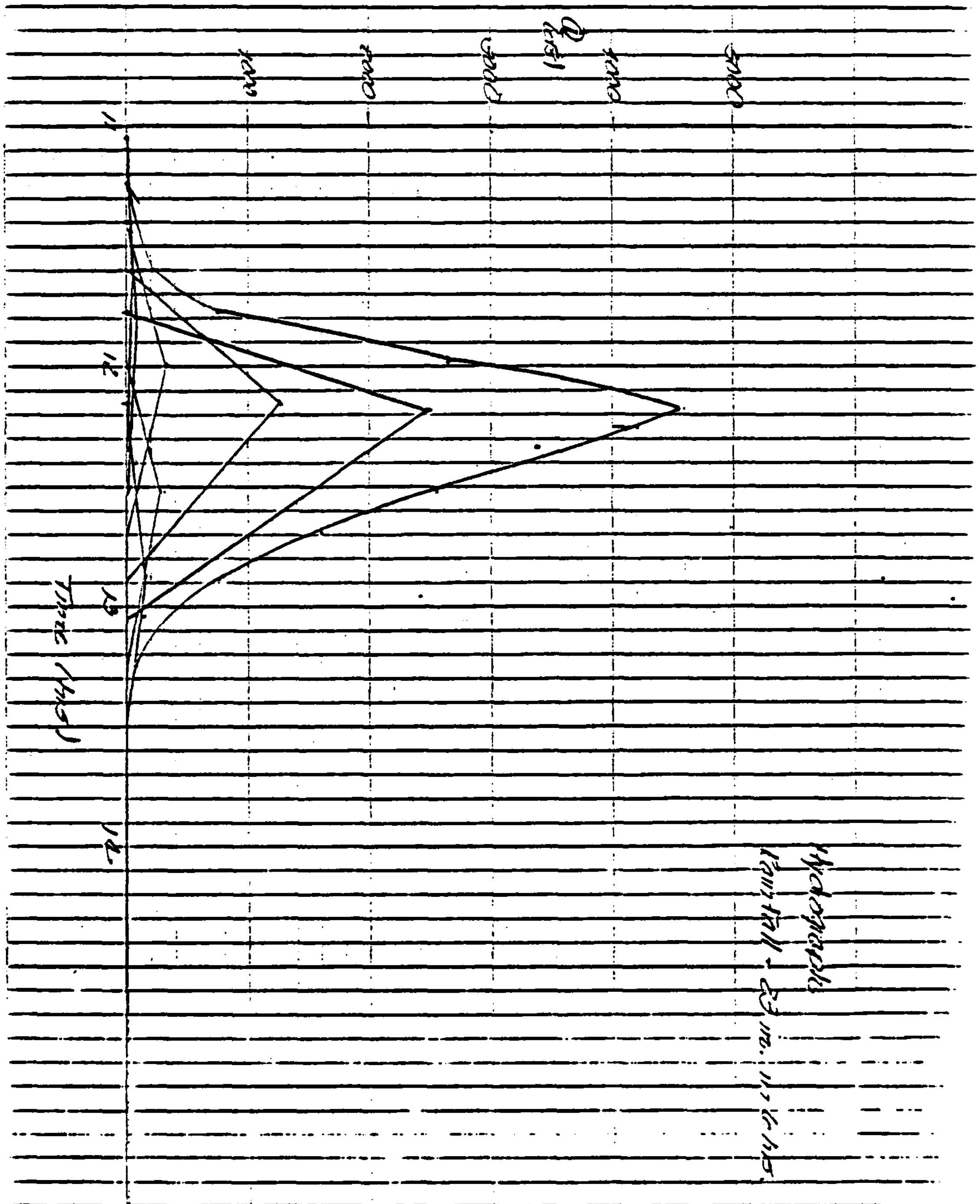
CLIENT: [illegible] JOB NO. [illegible] PAGE: 10
PROJECT: [illegible] DATE CHECKED: DATE: [illegible]
DETAIL: [illegible] CHECKED BY: COMPUTED BY: [illegible]



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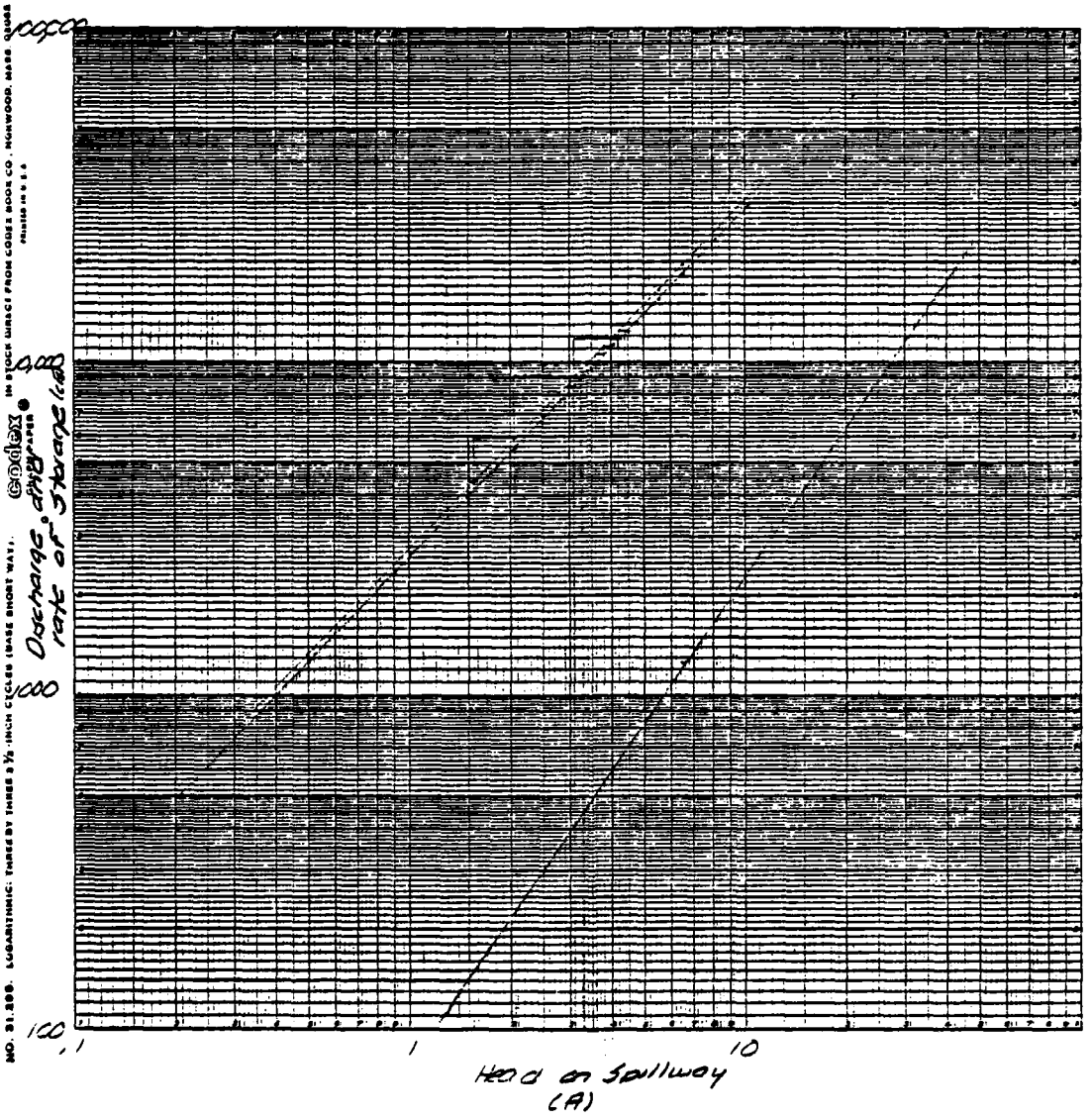
CLIENT [illegible] Group 1 JOB NO. [illegible] PAGE 11
PROJECT [illegible] DATE CHECKED ______ DATE 6/23/75
DETAIL [illegible] CHECKED BY ______ COMPUTED BY [illegible]

Calculation of Functional Rates of Storage

Time No	Time (hrs)	Obs Inflow (cfs)	Avg Inflow (cfs)	$\frac{S}{\Delta t} - \frac{O}{2}$ (cfs)	$\frac{S}{\Delta t} + \frac{O}{2}$ (cfs)	Hd on Spillway (ft)	Outflow Q (cfs)
0	11.0	0	0				0
1	11.25	10	5				10
2	11.5	140	75			1.5	140
3	11.75	630	385	4000	4385	1.55	146
4	12.0	3000	1315	4150	5965	2.05	225
5	12.25	4150	3575	5500	9075	3.10	410
6	12.5	2600	3375	9500	11875	4.00	610
7	12.75	1250	1925	11,100	13025	4.40	700
8	13.0	420	835	12,200	13035	4.42	706
9	13.25	60	240	12210	12450	4.20	655
10	13.5	0	30	11,600	11630	4.00	610
11	13.75	0	0	11,100	11,100	3.80	563
12	14.0	0	0	10,500	10,500	3.60	520
13	14.25	0	0	10,000	10,000	3.40	477
14	14.5	0	0	9400	9400	3.25	445
15	14.75	0	0	9000	9000	3.08	411
16	15.0	0	0	8450	8450	2.90	375


10000
1000
100
Discharge, cfs
rate of storage (A)
0.1
1
10
Head on spillway
(A)

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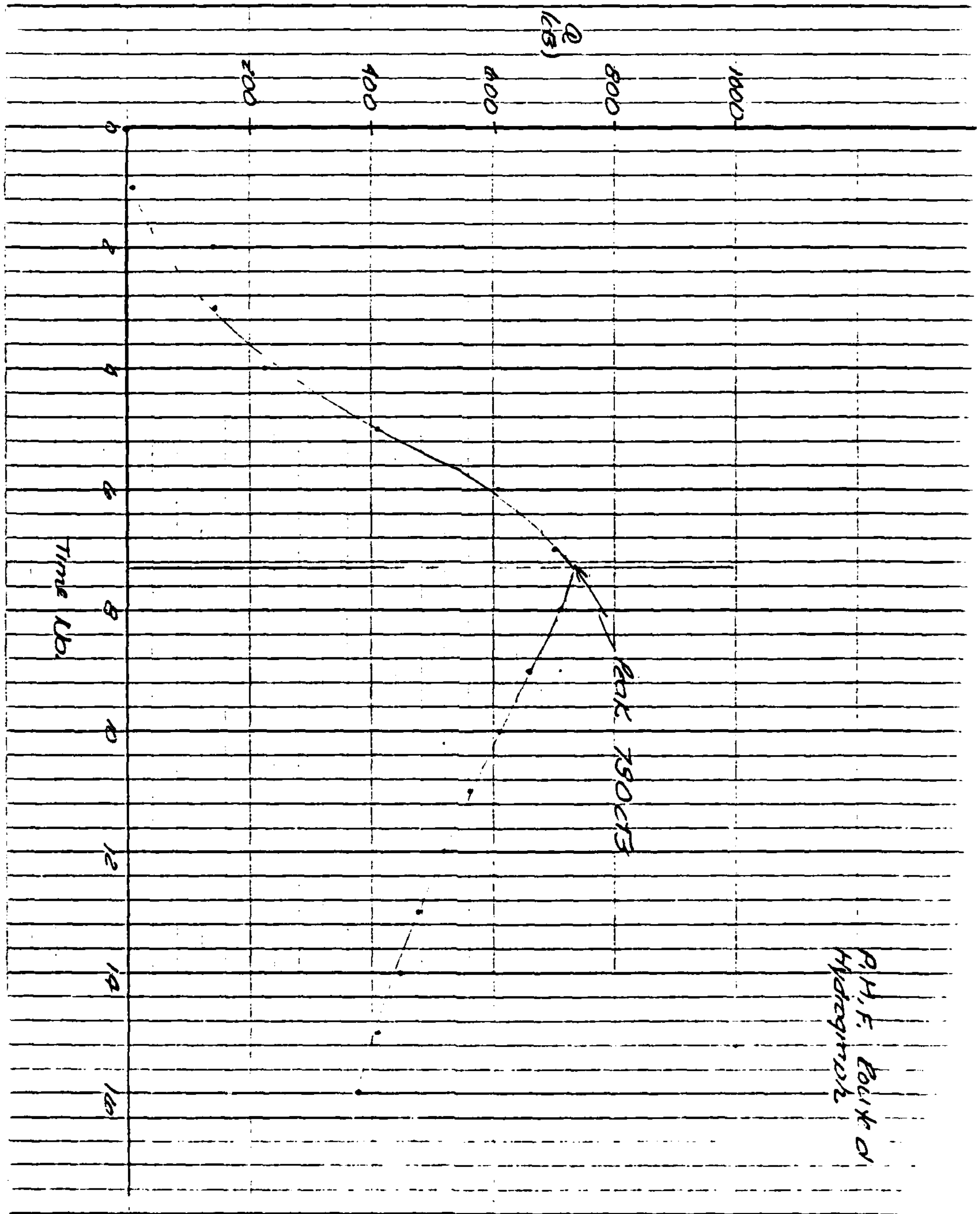
CLIENT H&A, U.D.T. Group I — JOB NO. 5121-A-27 — PAGE 13

PROJECT Lake Whittemore — DATE CHECKED ______ — DATE 7/3/78

DETAIL Hydrology Calc. — CHECKED BY ______ — COMPUTED BY [illegible]



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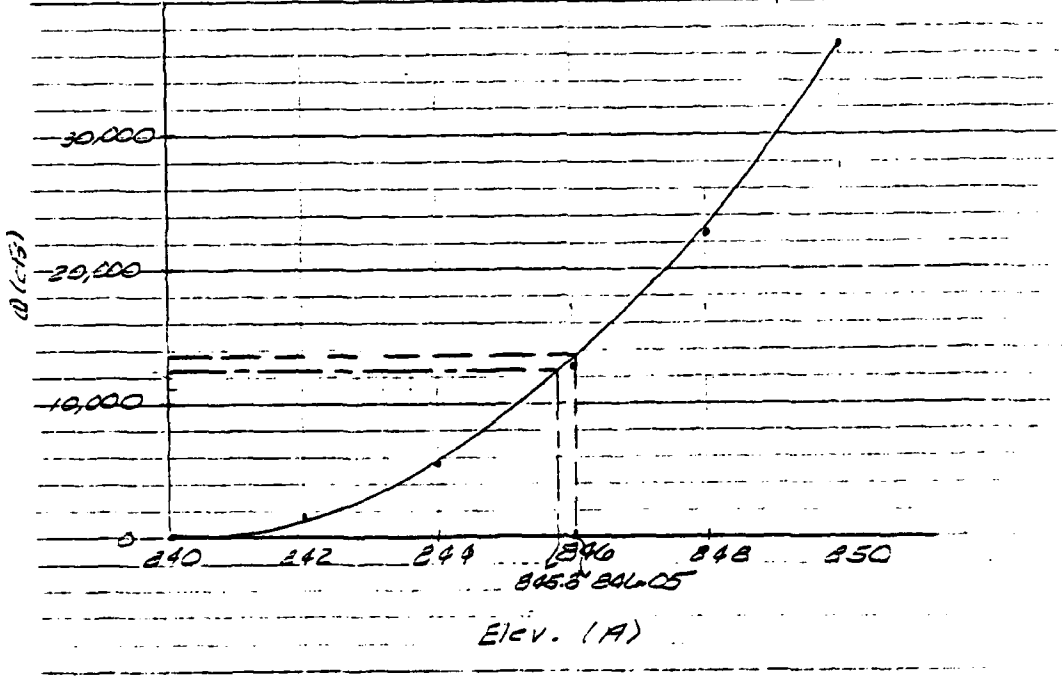
CLIENT Haley & Aldrich, N.O.I. JOB NO 5421-2-01 PAGE 9
PROJECT Lake Whitehall DATE CHECKED DATE 2.27.03
DETAIL Hydrology CHECKED BY COMPUTED BY A.SC

Stage-Discharge for Reach

-Say n = .035 for reach; heavy trees, brush on banks, rocky stream bed

$Q = \frac{1.49}{n} A^{2/3} S^{1/2} A$

Elev.	Area	W.P.	R	S	Q (CFS)
840	0 ft²	0 ft	0	.021212	0
842	190	113	1.68		1665
844	450	150	3.00		5806
846	780	180	4.33		12855
848	1200	226	5.31		22645
850	1700	261	6.51		36,764



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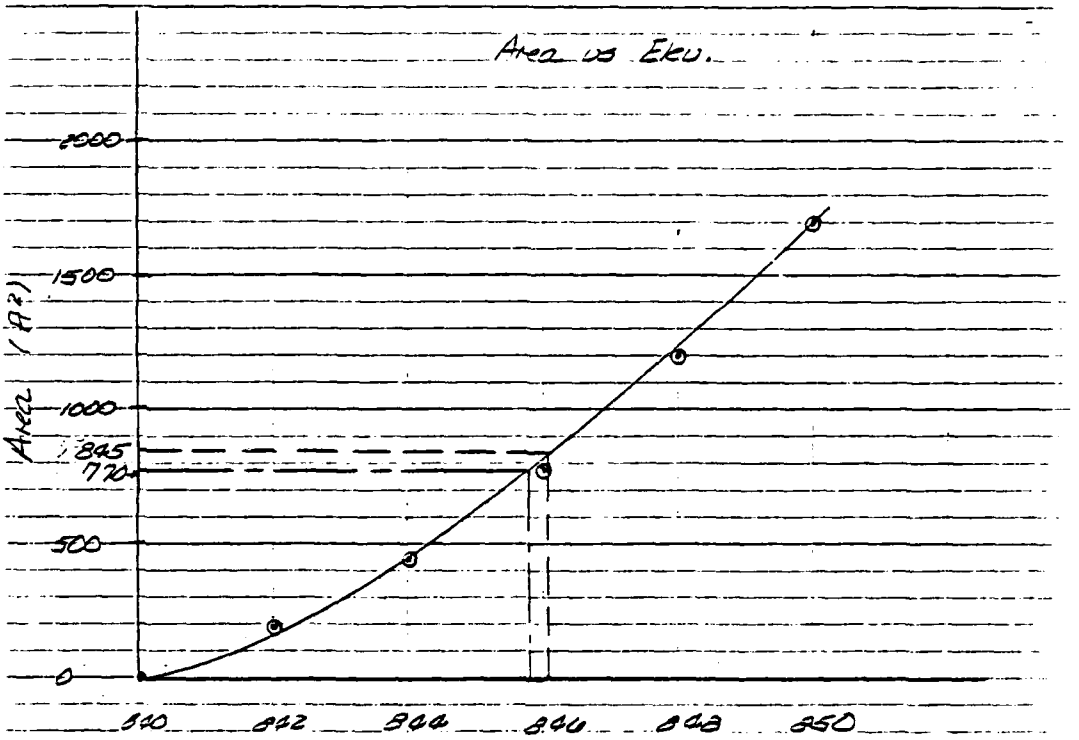
CLIENT Haley & Aldrich, Inc. JOB NO 561-R-ET PAGE 8
PROJECT Lake Winnemere DATE CHECKED DATE 7/27/78
DETAIL Hydrology CHECKED BY COMPUTED BY CLC



$Q_{p_1} = 13,523$ cfs

$V_1 = \frac{845\ A^2}{43,560\ \frac{A^2}{acre}} \times 1780' = 38.4$ acre-ft ≈ 1/2 S Okay

Q_{p_2} (TRIAL) $= 13,523\ cfs \left(1 - \frac{38.4}{495.9}\right) = 12,476$ cfs

$V_2 = \frac{770\ A^2}{43560\ \frac{A^2}{acre}} \times 1780 = 35.0$ acre-ft

$\frac{V_1 + V_2}{2} = \frac{38.4 + 35.0}{2} = 36.7$ acre-ft

$Q_{p_2} = 13523 \left(1 - \frac{36.7}{495.9}\right) = 12,522$ cfs

H100 = 585A

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CLIENT Haley & Aldrich
PROJECT Lake Whitehorse
DETAIL Hydrology

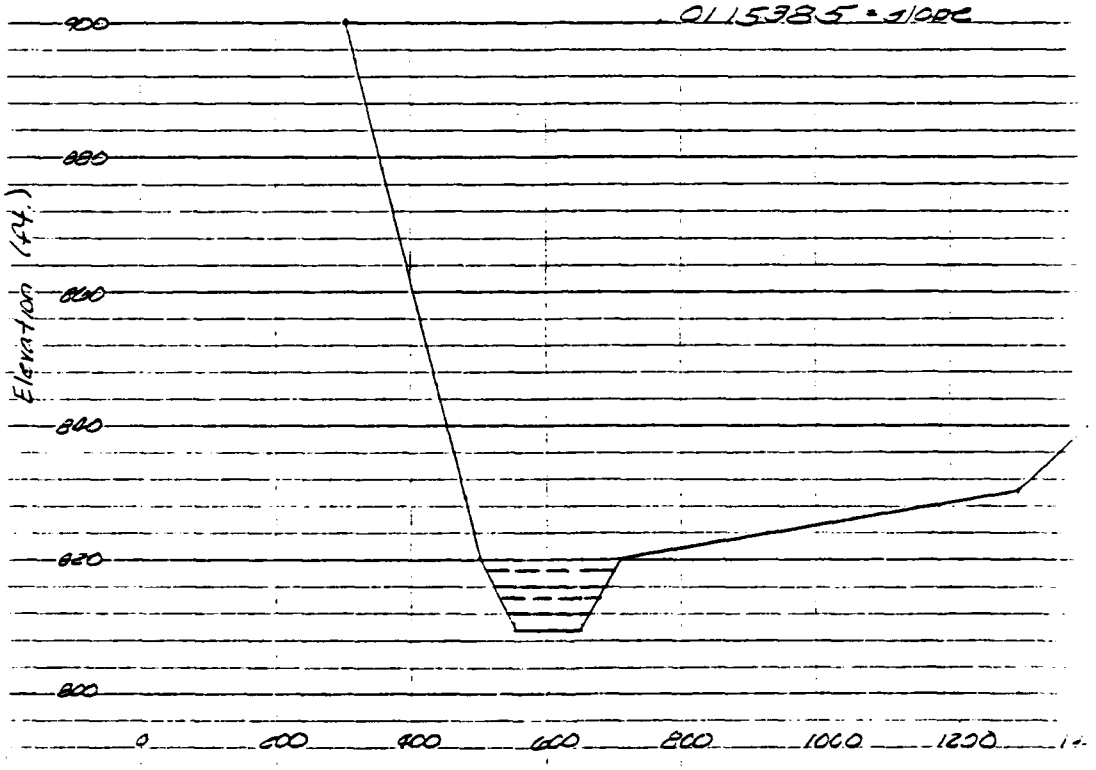
JOB NO 561-2-27
DATE CHECKED 8/14/73
CHECKED BY CFF

PAGE 5
DATE 7/27/73
COMPUTED BY

Reach No. 2 - 2600' to Main Street

3. Typical X-section (looking downstream)

Reach Slope (840' u.s. to 810' at Xsection
.011538S = 1/10pc



$Q = \frac{1.47}{n} E^{2/3} A S^{1/2} = \frac{1.47}{.030} \times (.011538)^{1/2} E^{2/3} A$

$Q = 5.335 E^{2/3} A$

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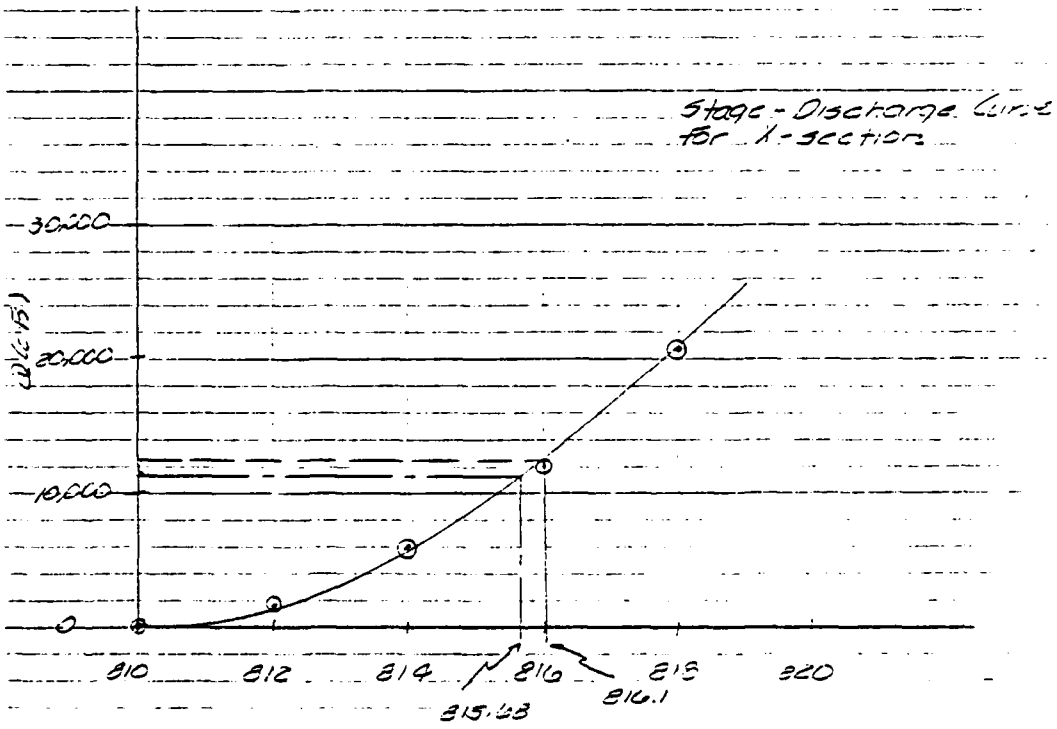
CLIENT _____ JOB NO _____ PAGE _____
PROJECT _____ DATE CHECKED _____ DATE _____
DETAIL _____ CHECKED BY _____ COMPUTED BY _____

Elev.	Area	WP	R	S	Q
810	0	0	0	.015335	0
812	225	125	1.8		1777
814	510	156	3.27		5996
816	810	171	4.74		12105
818	1180	196	6.02		22236

Stage - Discharge Curve for X-section



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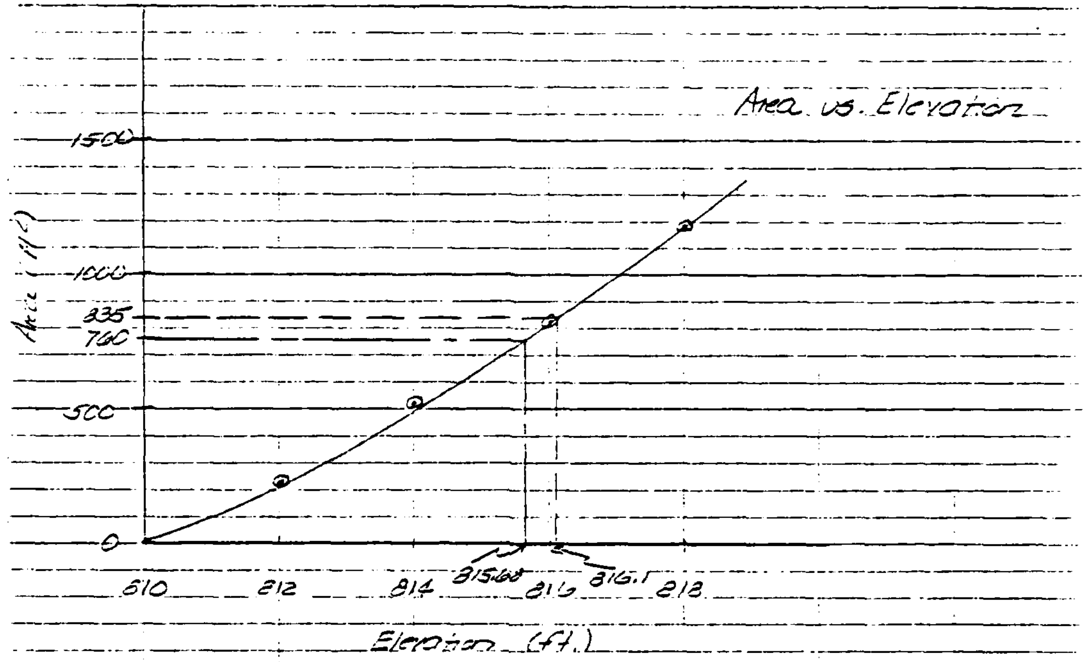
CLIENT [illegible] — JOB NO. [illegible] — PAGE [illegible]
PROJECT [illegible] — DATE CHECKED — DATE [illegible]
DETAIL [illegible] — CHECKED BY — COMPUTED BY [illegible]



$Q_{P1} = 12522$ cfs

$V_1 = \frac{835\ ft^2}{43560\ \frac{ft^2}{acre}} \times 2600 = 49.8$ acre-ft < 1/2 S okay

Q_{P2} (TRIAL) $= 12522 \left(1 - \frac{49.8}{495.9}\right) = 11{,}264$ cfs

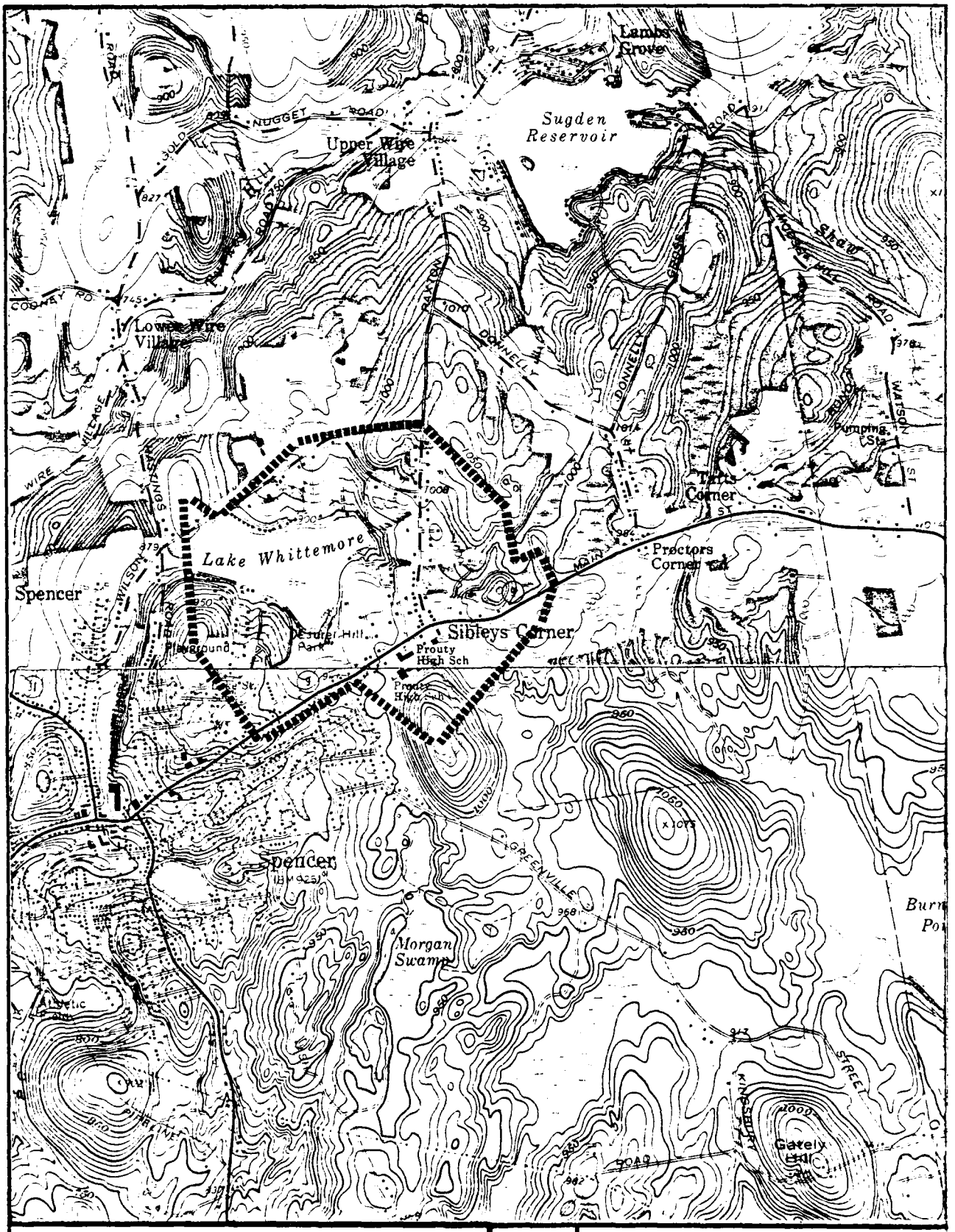
$V_2 = \frac{760\ ft^2}{43560\ \frac{ft^2}{acre}} \times 2600' = 45.4$ acre-ft < 1/2 S okay

$\frac{V_1 + V_2}{2} = \frac{49.8 + 45.4}{2} = 47.6$ Acre-ft

$Q_{P2} = 12522$ cfs $\left(1 - \frac{47.6}{495.9}\right) = 11320$ cfs

With Q = 11320 cfs, $H_{stream} = 5.70$

Elev. @ X-section = 815.70



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Consulting Engineers
Boston, Mass.

N

LAKE WHITTEMORE DAM
DRAINAGE AREA

SCALE 1: 24 000

APPENDIX E
INFORMATION AS CONTAINED IN THE NATIONAL INVENTORY OF DAMS

INVENTORY OF DAMS IN THE UNITED STATES

STATE	IDENTITY NUMBER	DIVISION	STATE	COUNTY	CONGR DIST.	STATE	COUNTY	CONGR DIST.	NAME	LATITUDE (NORTH)	LONGITUDE (WEST)	REPORT DATE DAY | MO | YR
MA	699	NED	MA	027	02				LAKE WHITTEMORE DAM	4215.3	7159.4	08SEP78

POPULAR NAME	NAME OF IMPOUNDMENT
	LAKE WHITTEMORE

REGION	BASIN	RIVER OR STREAM	NEAREST DOWNSTREAM CITY-TOWN-VILLAGE	DIST FROM DAM (MI.)	POPULATION
01	08	TR-SEVENMILE RIVER	SPENCER	0	9895

TYPE OF DAM	YEAR COMPLETED	PURPOSES	STRUCTURAL HEIGHT (FT.)	HYDRAULIC HEIGHT (FT.)	IMPOUNDING CAPACITIES MAXIMUM (ACRE-FT.)	IMPOUNDING CAPACITIES NORMAL (ACRE-FT.)	DIST	OWN	FED R	PRV/FED	SCS A	VER/DATE
RECTPG	1900	R	17	11	484	202	NED	N	N	N	N	28AUG78

REMARKS

D/S HAS	SPILLWAY CREST LENGTH	SPILLWAY TYPE	SPILLWAY WIDTH (FT.)	MAXIMUM DISCHARGE (FT.)	VOLUME OF DAM (CY)	POWER CAPACITY INSTALLED (MW)	POWER CAPACITY PROPOSED (MW)	NAVIGATION LOCKS NO.	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)	LENGTH (FT.)	WIDTH (FT.)
1	300	U	20	850												

OWNER	ENGINEERING BY	CONSTRUCTION BY
TOWN OF SPENCER		

REGULATORY AGENCY			
DESIGN	CONSTRUCTION	OPERATION	MAINTENANCE
NONE	NONE	NONE	MA DPW

INSPECTION BY	INSPECTION DATE DAY | MO | YR	AUTHORITY FOR INSPECTION
HALEY & ALDRICH, INC.	12MAY78	PL 92-367

REMARKS

END

FILMED

7-85

DTIC